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FINAL ENVIRONMENTAL IMPACT STATEMENT. PERMIT APPLICATION BY UNI--ETC(U)
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FINAL ENVIRONMENTAL IMPACT STATEMENT

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PERMIT APPLICATION BY UNITED STATES STEEL CORP. PROPOSED LAKE FRONT STEEL MILL CONNEAUT, OHIO

(11) 1979

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VOLUME 3

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Prepared by U.S. Army Engineer District , Buffalo 1776 Niagara Street Buffalo, New Yo

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CHAPTER FOUR: ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION.

Introduction

4.1
This chapter addresses the associated impacts which are inherent in the construction, operation, and maintenance of the proposed Lakefront Steelmaking Facility at Conneaut, OH. The action with which this EIS is concerned is the application by the United States Steel Corporation for a Department of the Army permit to construct a water intake and an effluent discharge system in Lake Erie; dredge the area immediately adjacent to the unloading dock; install a raw materials handling conveyor which will span the harbor between the unloading dock and the existing shoreline; and the installation of a culvert in Turkey Creek. The potential direct environmental impacts associated with authorizing these structures and the dredging largely will be borne by the receiving waters and their biota. Indirect impacts of authorizing the construction would result from operation of the proposed facility and would include effects on air quality, ambient noise levels, aesthetics, sociological conditions, water quality, economics, and others. To describe fully the total array of potential environmental effects, this section details the primary and secondary impacts of construction, operation, and maintenance of the entire facility.

Impact on the Human Environment

Introduction and General Summary

4.2
Establishment of a study area for the assessment of plant-related primary and secondary impact was accomplished using two basic criteria. The first involved the consideration of areas controlled by political subdivision while the second dealt with the selection of various sites where plant-related impacts would be most illustrative. Through the application of these criteria to the area around the proposed plant site, the regional, principal (including coastal communities), and local study area concept was established. A complete discussion regarding the selection of the various study areas is presented in Chapter Two of this statement.

Socio-Economic Impacts

4.3
Identification and quantification of socio-economic impacts is a complex task which involves the analysis of many variables interacting with each other on an individual or group basis. To accomplish this task a computerized accounting system, the SIMPACT IV

Model, was employed to predict facility-related impacts during the 1979-1990 analysis period. The model analyzes impact on a wide range of human environmental variables such as economics, demographics, private and public infrastructure, land use, vehicle miles traveled, energy needs, secondary environmental elements, fiscal expenditures, taxes, and transfers. Each multidisciplinary analysis proceeds at a considerable level of detail with secondary business volume, as an example, disaggregated into 18 sectors. The model also differentiates the impacts on each variable in terms of time, political subdivision, and the anticipated plant construction and operations schedule. A complete discussion of the model, its input and output factors, and logic can be found in Working Paper No. I, SIMPACT IV Model: Conceptual Design and Methodology. Copies of this document, as well as other pertinent working papers, were appended to the draft Environmental Impact Statement.

4.4
To insure that the socio-economic impact analysis was as thorough and accurate as possible, an independent consultant was retained by the Corps of Engineers to evaluate the SIMPACT IV model and its output. The individual selected for this task was Dr. Brian J.L. Berry, Director of the Laboratory for Computer Graphics and Spatial Analysis Graduate School of Design, Harvard University, Cambridge, MA (Contract Number DACW49-77-C-0235). Specific responsibilities defined in the contract with Dr. Berry included the following: review and evaluation of the socio-economic baseline data used by the applicant to project the primary and secondary plant-related impacts; analysis of the content and accuracy of the working papers used to support certain assumptions made in the SIMPACT IV model; evaluation of the input factors used in the SIMPACT model and a judgement as to whether or not the output is sufficiently accurate to identify and project primary and secondary environmental impacts during the construction and operation of the proposed steel mill. A report prepared by Dr. Berry summarizing his findings relative to the quality of the socio-economic impact analysis and the characteristics of the SIMPACT IV model is appended to this statement.

4.5
Analyzing the operations phase impact, estimates of likely supplier, customer, and population related industrial development in the regional study area were derived utilizing the following sources: anticipated product mix of the Lakefront plant; geographic proximity of the facility to steel customers; established marketing practices in the steel industry; industrial base in the Regional Study Area; plant siting criteria of in-utilizing steel; inter-industry steel purchasing relationships exhibited within selected States and regions of the United States; and past experiences regarding secondary development at major industrial development sites. A similar set of data

sources was utilized in the construction impact analysis. These were used to define the indirect impact of the Lakefront Plant in terms of business volume, employment, and payrolls generated by customer purchases from or supplier sales to the proposed facility during construction and operations. Induced economic impacts created by the spending of direct and indirect payrolls were determined based on an examination of the size and diversity of the area's economic base. A summary of the socio-economic impacts generated during the construction and/or operation of the proposed facility is shown in Figures 4-1 through 4-4.

Social and Economic Factors Directly Related to the Construction and Operation of the Proposed Plant

4.6
This section presents a brief description of the construction and operations phases of the proposed Lakefront facility. This description focuses upon the proposed schedule of plant construction, planned capacity, and product mix of the facility, and estimated manpower requirements. The material contained in this section has been drawn from the detailed information and descriptions contained in the following working papers, "Construction Labor Requirements and Characteristics" and "Economics and Demographics Operations Phase." These documents, prepared by the applicant's consultant, identify major sources of data and information, present the approach and methodology employed in the analysis, and highlight the principal assumptions identifying many of the parameter and factor estimates appearing throughout the Environmental Impact Statement. To avoid unnecessary duplication, these estimates have been presented in this section without the detailed justification, hypotheses, or data sources. However, the reader is urged to review these estimates and findings presented in this section. Copies of the working papers used for this project were appended to the draft Environmental Impact Statement.

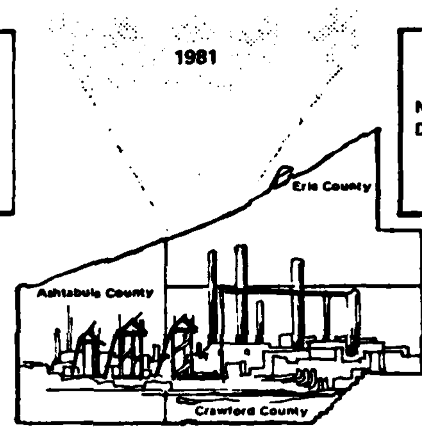
Proposed Construction and Operations Schedule

4.7
Construction and operation schedules presented in this final Environmental Impact Statement are based on the assumption that site preparation work would begin during the first quarter of 1979. The reviewer is cautioned that this is a hypothetical date which has been established solely for the purpose of predicting plant-related impacts over the short and long-term. In actuality, construction of the Lakefront plant will not commence until such time as all of the necessary Federal, State, and local regulatory permits have been secured and the applicant has determined that sufficient capital is available to proceed with this action.

Direct Employment	11,085
Direct Payroll (mm $)	190

Total Employment	13,170
Total Payroll (mm $)	210
Total Gross Business Volume (mm $)*	100
Total Retail Gross Business Volume (mm $)	35

New Resident Population	7,875
Demand for Housing Units	3,705



Number of School Students	1,255
Number of School Staff	70
Number of Hospital Beds	35
Number of Doctors and Dentists	15
Number of Police and Fire Personnel	15
Number of General Government Employees	15
Demand for Water (mm g/d)*	1.1
Solid Waste Generation (tons/year)*	5,150
Total Vehicle Registrations*	4,415

State Personal Income Tax Revenues (mm $)*	0.6
State Sales Tax Revenues (mm $)*	2.0
Local Personal Income Tax Revenue (mm $)*	1.2

*Excludes Lakefront facility

Note: All estimates have been rounded for summary presentation purposes

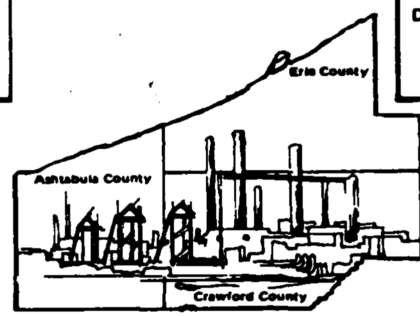
Source: Arthur D. Little Inc., estimates.

FIGURE 4—1 SUMMARY OF SOCIO-ECONOMIC IMPACT—1981

Direct Employment	5,380
Direct Payroll (mm $)	85

Total Employment	7,800
Total Payroll (mm $)	110
Total Gross Business Volume (mm $)*	115
Total Retail Gross Business Volume (mm $)	35

1983



New Resident Population	8,940
Demand for Housing Units	2,460

Number of School Students	2,050
Number of School Staff	155
Number of Hospital Beds	40
Number of Doctors and Dentists	20
Number of Police and Fire Personnel	20
Number of General Government Employees	20
Demand for Water (mm g/d)*	1.3
Solid Waste Generation (tons/year)*	5,465
Total Vehicle Registrations*	5,065

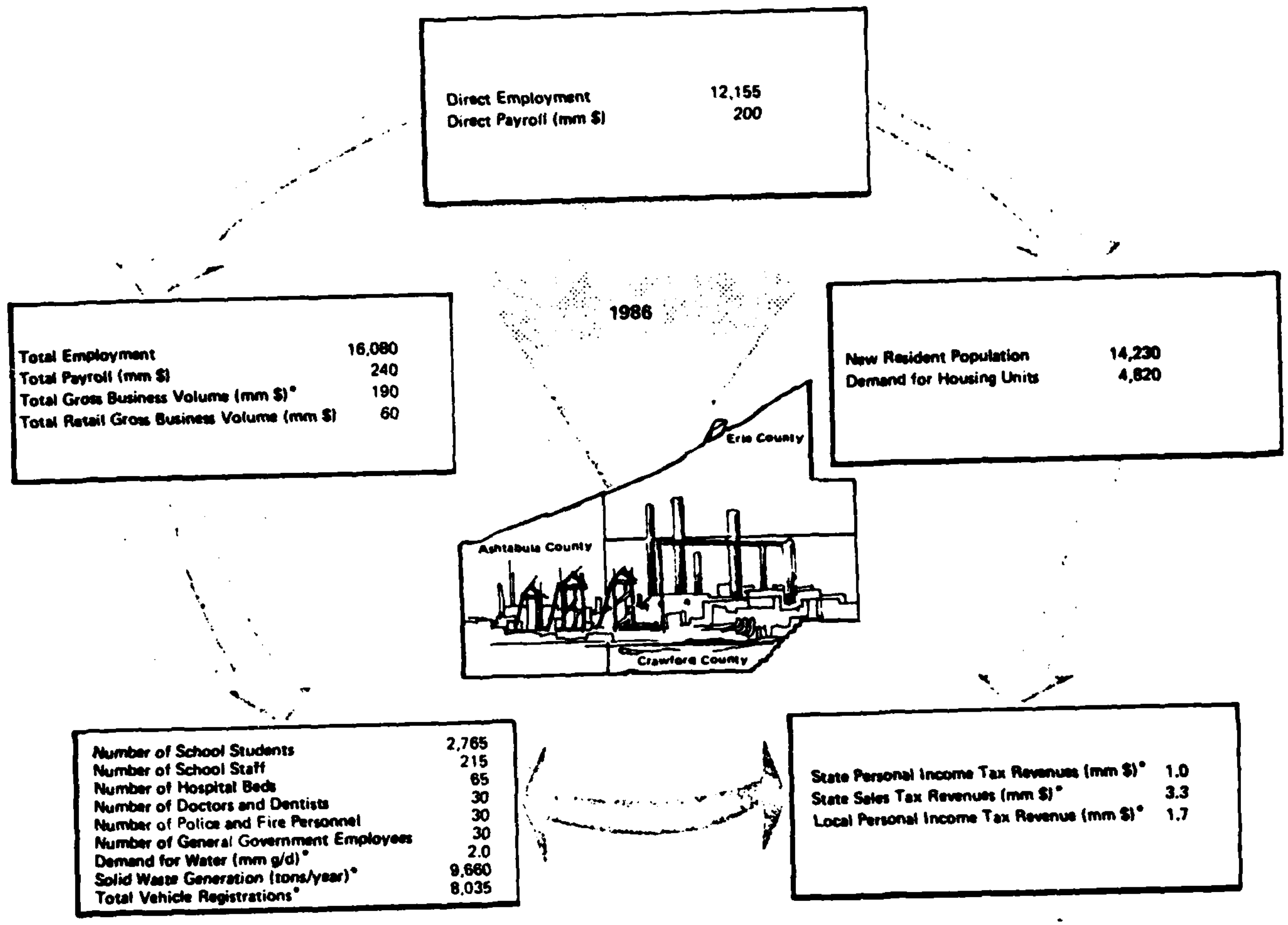
State Personal Income Tax Revenues (mm $)*	0.7
State Sales Tax Revenues (mm $)*	2.0
Local Personal Income Tax Revenue (mm $)*	0.9

*Excludes Lakefront facility

Note: All estimates have been rounded for summary presentation purposes

Source: Arthur D. Little Inc., estimates.

FIGURE 4–2 SUMMARY OF SOCIO-ECONOMIC IMPACT—1983



*Excludes Lakefront facility

Note: All estimates have been rounded for summary presentation purposes

Source: Arthur D. Little Inc. estimates.

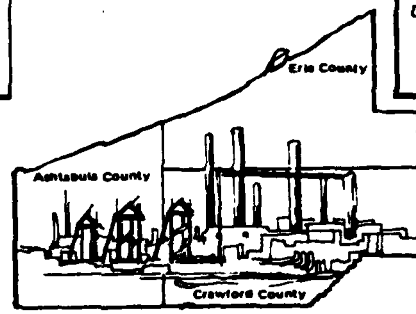
FIGURE 4–3 SUMMARY OF SOCIO-ECONOMIC IMPACT—1986

Direct Employment	8,455
Direct Payroll (mm $)	136

1990

Total Employment	12,675
Total Payroll (mm $)	175
Total Gross Business Volume (mm $)*	205
Total Retail Gross Business Volume (mm $)	60

New Resident Population	15,810
Demand for Housing Units	4,350



Number of School Students	3,380
Number of School Staff	260
Number of Hospital Beds	75
Number of Doctors and Dentists	35
Number of Police and Fire Personnel	40
Number of General Government Employees	35
Demand for Water (mm g/d)*	2.2
Solid Waste Generation (tons/year)*	11,820
Total Vehicle Registrations*	8,950

State Personal Income Tax Revenues (mm $)*	1.2
State Sales Tax Revenues (mm $)*	3.4
Local Personal Income Tax Revenue (mm $)*	1.6

*Excludes Lakefront facility

Note: All estimates have been rounded for summary presentation purposes

Source: Arthur D. Little Inc. estimates.

FIGURE 4–4 SUMMARY OF SOCIO-ECONOMIC IMPACT—1990

4.8
Construction of the proposed Lakefront facility will take eight years, according to present schedules proposed by the applicant's engineering department. Plans call for accomplishing this construction in two steps with about a year between steps to allow for operational shakedowns. Thus, each step of facility construction is expected to span a period of about four years. Assuming the appropriate licenses and permits are secured from the various regulatory agencies involved in this proposal, the applicant plans to initiate site preparation during the first quarter of 1979, with construction of the various facilities beginning shortly thereafter. According to this schedule, Step I construction should be completed by the end of the third quarter of 1982. Following an 18-month period, construction of Step II is planned to begin during the second quarter of 1984. Many of these facilities built during Step II will be similar in function to those of Step I except for the construction of the plate mill. By the third quarter of 1987, Step II construction is expected to be completed.

Planned Capacity and Product Mix of the Proposed Facility

4.9
Steelmaking capacity is expected to equal 3.75 million tons during Step I, reaching a total of 7.5 million tons by the completion of Step II (refer to Table 4-1). Principal products during Step I operations will be steel sheets for shipment to the applicant's customers and other divisions within their organization. Plate finishing capability would be added during Step II. Based on a construction start-up during the first quarter of 1979, production at the facility is expected to begin by the second quarter of 1982. However, usual start-up problems are anticipated to keep tonnage during the three quarters of first year operation at about 75 percent of rated capacity.* By 1983, production on an annual basis is expected to proceed at fully-rated plant capacity (refer to Table 4-2). Construction for Step II is scheduled to begin by the second quarter of 1984, and additional steelmaking capacity should be operational by the second quarter of 1987. Similar to Step I start-up, production during 1987 is assumed equal to fully-rated Step I capacity plus about 55 percent of the incremental annual capacity added during Step II.** Beginning in 1988, production of the facility is assumed to

*Since steelmaking operations are expected to commence by the second quarter of 1982, production during the first year will be about 55 percent of total rated annual capacity (nine months of production of 75 percent of capacity -- 9/12 X 75/100 = 9/16 = 55 percent).

**Similar to Step I, production in the first year from the additional capacity associated with Step II will be at about 55 percent (9/16) of rated capacity.

Table 4-1

Operations - Plant Capacity of the Proposed Lakefront Plant (Millions of Tons)

	Step I		Step II	
	English	Metric	English	Metric
Coke Ovens	1.790	1.625	3.580	3.250
Sinter Plant	3.400	3.080	3.400	3.080
Blast Furnaces	3.585	3.250	7.170	6.500
Steelmaking	3.750	3.400	7.500	6.800
Slab Castings	3.500	3.175	7.000	6.350
Hot Strip Mill	3.360	3.050	5.000	4.535
Hot Band Support	1.400	1.270	1.900	1.725
Hot Rolled Sales	-	-	-	-
Ship Direct	0.750	0.680	1.250	1.135
Finished	1.150	1.045	1.750	1.590
Plate Mill	-	-	1.600	1.450
Plate Finishing	-	-	1.520	1.380

Source: United States Steel Corporation.

reach 100 percent of rated annual capacity (7.5 million tons per year). As the data in Table 4-2 indicate, steel sheets will be the only product shipped during the initial years of operation. Sheets will remain the dominant product even with the addition of Step II capacity and plate finishing capability. Sheet production at the facility will be hot strip only, the proposed facility will have no cold-rolling capability during the 1980's.

Value of Construction and Payroll

4.10
The construction cost of the Lakefront facility has been estimated at $3.5 billion (1975 dollars) which includes a total associated payroll of about $675 million. Since manpower requirements are greatest during Step I activity, the bulk of the payroll (and construction cost) will be incurred during the 1979-1982 period.

Step I - Construction Cost $2.1 billion
Payroll $435 million

Step II - Construction Cost $1.4 billion
Payroll $240 million

The amount of construction actually completed and the value of payrolls earned show a distributional pattern similar to that associated with total manpower needs. Peaks are reached during the second and third years of both Steps I and II facility construction.

4.11
Due to their differing characteristics, requirements, and impact, the construction and operations phase of the proposed Lakefront Plant have been analyzed separately.

Construction

4.12
Data on the proposed construction schedule and manpower needs were made available by U.S. Steel. These data served to define the length and time response of facility construction and to identify the demand for construction workers by various occupation/skill categories. Estimates of the likely source of the construction workforce were based largely upon data provided by local building union officials. These data were supplemented by basic data on past and present construction projects determined to be relevant to this analysis, and an extensive series of personal interviews by the applicant's consultant with Contractor management personnel, academic sources, and officials of power companies who have managed or been involved in projects comparable to the Lakefront development. The approach

Table 4-2

Annual Production at the Proposed Lakefront Plant

Year	Liquid Steel Production	Shipments: Sheet Trade	Shipments: Sheet Interworks	Shipments: Plate Trade	Shipments: Total
1981	-	-	-	-	-
1982	2.11	1.07	0.79	-	1.86
1983	3.75	1.90	1.40	-	3.30
1984	3.75	1.90	1.40	-	3.30
1985	3.75	1.90	1.40	-	3.30
1986	3.75	1.90	1.40	-	3.30
1987	5.86	2.52	1.68	0.86	5.06
1988	7.50	3.00	1.90	1.52	6.42
1989	7.50	3.00	1.90	1.52	6.42
1990	7.50	3.00	1.90	1.52	6.42

Source: United States Steel Corporation

begins with the identification of the demand for construction workers in various occupation/skill categories on a quarterly basis during the entire construction phase. Based upon data available from local building unions, estimates of the number of workers likely to be available within the Regional Study Area and within commuting distance were derived. For those skill categories in which demand continued to exceed supply, the balance was assumed to be filled by construction workers who would in-migrate to the area from outside a 100-mile commuting distance. Based on union data and the experience on several related projects, estimates were made of the number of these in-migrants that would likely move into the Regional Study Area, bringing their families with them. The remaining in-migrants were assumed to be weeklies, workers who live in the area during the workweek but commute back to their homes and families outside of the Regional Study Area on weekends. The socio-economic characteristics of construction workers served as an important input in this part of the analysis. The results of this study included estimates of the number of construction workers likely to relocate to the Regional Study Area during the building phase, the split between movers and weeklies, and the likely residential distribution of the in-migrants among the Coastal Communities of the Regional Study Area. These findings provided the necessary input into the remaining parts of the socio-economic impact analysis. These include likely secondary industrial developments and impacts upon community population, infrastructure, tax, and other related measures.

Direct Construction Profile

Number of Workers

4.13
Construction of the Lakefront facility is estimated to require nearly 30,000 man-years of construction manpower. About 65 percent of this total would be required for Step I activity. Table 4-3 and Figure 4-5 present a tabular and graphic description of the timing and total manpower requirements for the two-step construction project. Over the course of Step I activity, more than 19,000 man-years of construction employment will be created, with the largest concentration occurring during 1981. While the timing and requirement configuration for Step II are similar to Step I, construction manpower levels are much less. Based upon estimates of construction, manpower needs during each quarter of the building period, peak manning requirements are reached at the following times:

Step I	1979	fourth quarter	2,950
	1980	fourth quarter	8,800
	1981	second quarter	10,500
	1982	first quarter	4,500

Table 4-3

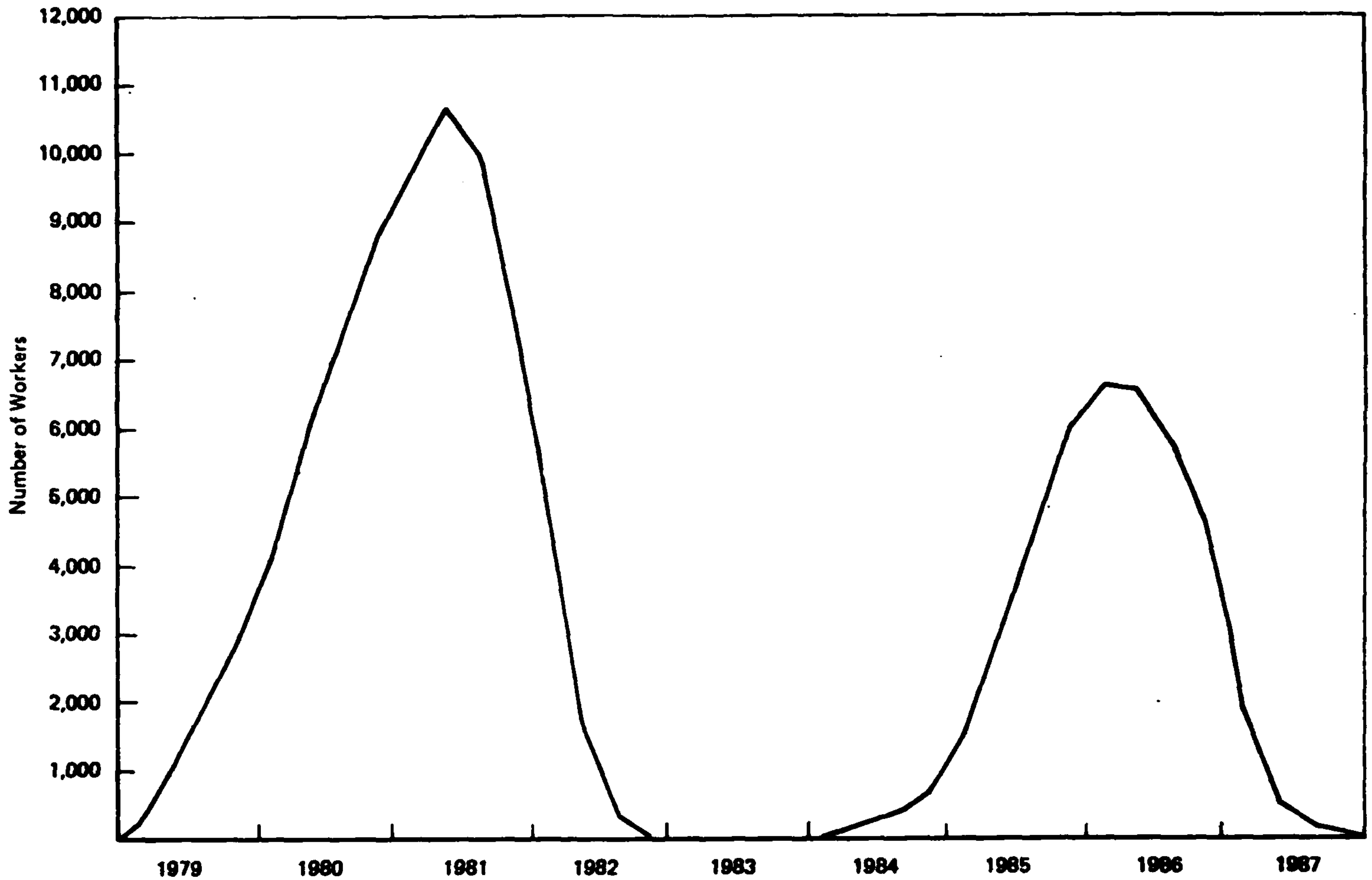
Construction Manpower Requirements and Schedule

Step I	Total Personnel (Quarterly)	Man-Years (Quarterly)	Total Personnel[1] (Annualized)
1979			
1 Quarters	250	62.5	
2	1000	250.0	
3	1950	487.5	1540
4	2950	737.5	
1980			
1	4150	1037.5	
2	5900	1475.0	
3	7350	1837.5	6550
4	8800	2200.0	
1981			
1	9670	2417.5	
2	10500 (peak)	2625.0	
3	9850	2462.5	9380
4	7500	1875.0	
1982			
1	4500	1125.0	
2	1525	381.25	
3	320	80.0	1585
4	-	-	
Total (Step I)		19,053.75	
Step II			
1984			
1	-		
2	220	55.0	
3	320	80.0	290
4	630	157.5	
1985			
1	1450	362.5	
2	3000	750.0	
3	4350	1087.5	3700
4	6000	1500.0	
1986			
1	6600 (peak)	1650.0	
2	6500	1625.0	
3	5700	1425.0	5825
4	4500	1125.0	
1987			
1	1880	470.0	
2	555	138.75	
3	150	37.5	645
4	-	-	
Total (Step II)		10,463.75	

[1] Rounded

Source: United States Steel Corporation.

Figure 4-5 Construction Manpower Requirements at the Proposed Lakefront Project



Source: United States Steel Corporation.

Step II -	1984 -	fourth quarter -	630
	1985 -	fourth quarter -	6,000
	1986 -	first quarter -	6,600
	1987 -	first quarter -	1,880

Thus, during both steps, activity builds quickly, reaching peak levels during the third year of construction and then slackens off rapidly.

Maximum manpower levels are reached in the second quarter of 1981 (at 10,500) during Step I and in the first quarter of 1986 (at 6,600) during Step II.

Skill Requirements

4.14
Workers from sixteen affiliated occupational categories will be required during the construction phase of the project. These skill categories are as follows:

Laborers	Pipefitters
Carpenters	Sheet Metal Workers
Millwrights	Teamsters
Ironworkers	Painters
Bricklayers	Plasterers and Cement Finishers
Operating Engineers	Insulation Workers
Boilermakers	Plumbers
Electricians	Pile Drivers

4.15
Table 4-4 shows the peak number of jobs by skill category for each year of construction during Steps I and II. Table 4-5 presents comparable data on the two administrative personnel (non-union) categories. Figure 4-6 illustrates the quarterly manpower requirements for the nine major unionized skill categories.

4.16
As can be seen from the manpower requirements for the first year of Step I, a substantial number of laborers, carpenters, ironworkers, operating engineers, electricians, and pipefitters are needed at the outset of the project for site preparation, foundation work, and preliminary structural work. During the second year, the requirement for ironworkers, laborers, carpenters, electricians, and pipefitters are especially heavy. The third year (1981) represents the peak of activity for all of the skill categories during the first step of construction; requirements are scheduled to drop off substantially during the fourth quarter of that year. (Total manpower required

Table 4-4

Peak Construction Worker Requirements by Skill/Occupation Category(1)

	Step I				Step II			
Skill Category	1979	1980	1981	1982	1984	1985	1986	1987
Laborers	500	1300	1500	550	150	700	650	100
Carpenters	550	1100	900	250	-	400	450	-
Millwrights	50	500	900	350	-	600	700	300
Ironworkers	450	1600	1600(2)	450	-	800	700	100
Bricklayers	50	500	800	200	-	450	700	150
Operating Engineers	300	300	300	150	80	200	200	30
Boilmakers	-	600	700	100	-	400	500	-
Electricians	250	900	1200	900	50	700	800(2)	350
Pipefitters	200	1100	1500	900	100	900	900(2)	450
Other Crafts								
Sheet Metal Workers	45	60	75	38	15	67	75	30
Teamsters	150	200	250	125	50	225	250	100
Painters	15	20	25	12	5	22	25	10
Cement Finishers and Plasterers	15	20	25	13	5	23	25	10
Insulation Workers	45	60	75	37	15	68	75	30
Plumbers	15	20	25	13	5	23	25	10
Pipe Drivers	15	20	25	12	5	22	25	10
Total Peak Quarterly Requirement	2650	8300	9900	4100	480	5600	6100	1680

(1) The values in the table represent the estimated total number of workers required during the peak quarter for each year.

(2) Because peak requirements for each skill category will vary by quarter in a given year, the totals shown may not correlate precisely with the actual peak requirement for each skill category.

Source: U.S. Steel Engineering Department.

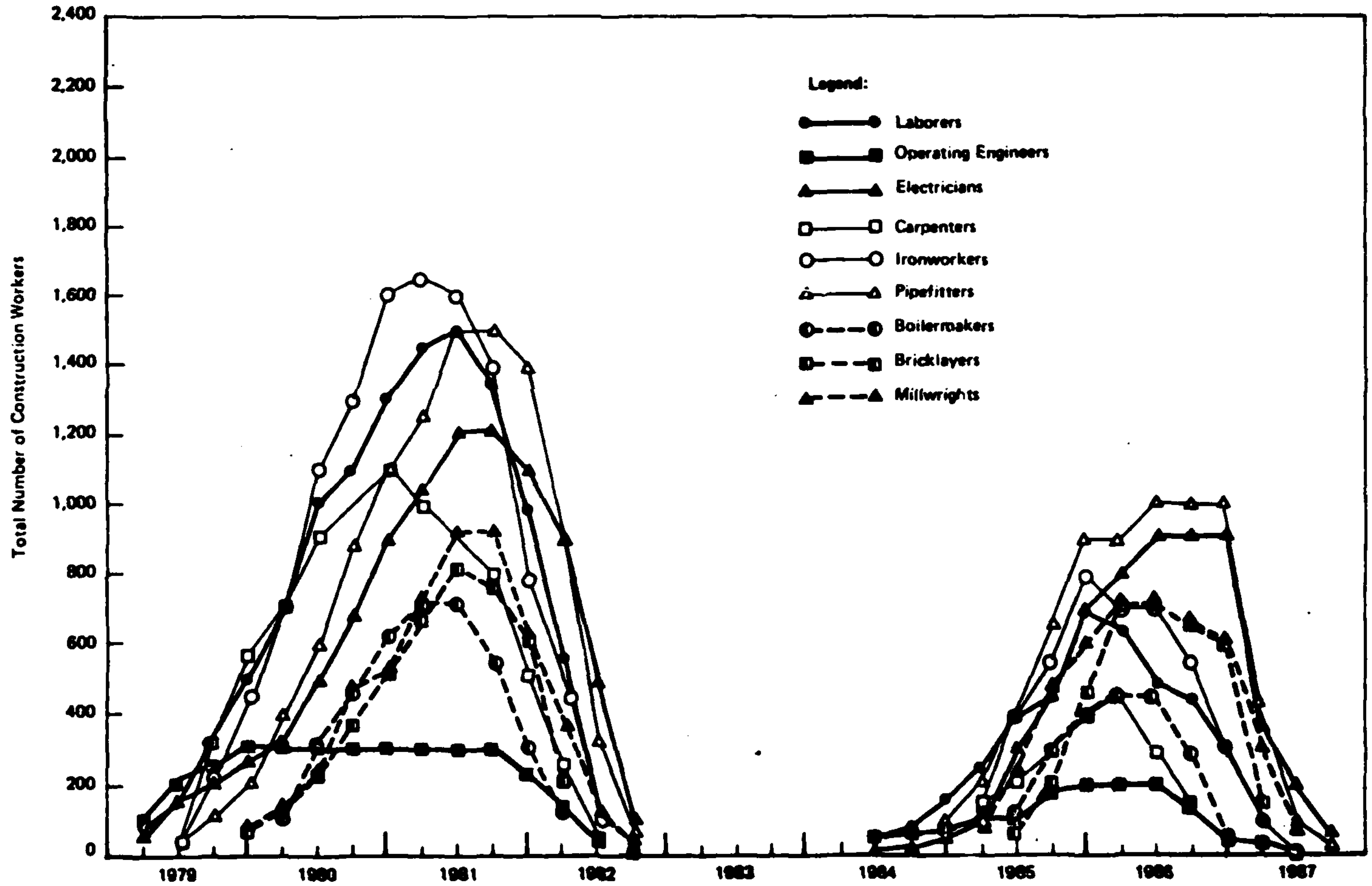
Table 4-5

Administrative Personnel

	Step I				Step II			
	1979	1980	1981	1982	1984	1985	1986	1987
On-site Administration (U.S. Steel)	120	150	150	120	50	100	150	80
On-site Administration (Subcontractor Personnel)	180	350	450	280	100	300	350	120
Totals	300	500	600	400	150	400	500	200

Source: U.S. Steel Engineering Department.

Figure 4-6 Estimated Construction Manpower by Craft
Proposed Lakefront Plant - Steps I & II



Source: United States Steel Corporation.

during the second quarter of the third year is scheduled for 10,500, this is scheduled to drop to 9,850 during the third quarter and then down to 7,500 for the fourth quarter). The fourth year is scheduled to require substantially less manpower during each successive quarter until Step I completion in the third quarter of the year.

4.17
Manpower requirements for Step II of the construction project are illustrated in Table 4-4. During the first year, the main skill categories needed are laborers, operating engineers, and pipefitters. Construction during the second year requires a heavy complement of laborers, ironworkers, electricians, pipefitters, and millwrights, with fewer but still considerable numbers of carpenters, bricklayers, boilermakers, operating engineers, and teamsters also needed. By the third year, requirements for pipefitters, electricians, boilermakers, millwrights, bricklayers, and carpenters are at their peak, but the number of necessary laborers and ironworkers is down slightly from the previous year. The fourth and last year of Step II construction requires substantially fewer workers in each skill category. Only pipefitters, electricians, millwrights, and bricklayers are expected to be needed in significant numbers. There is only a moderate need for such affiliated skill categories as teamsters, sheet metal workers, insulators, cement finishers, painters, pile drivers, and plumbers. Although construction is scheduled for completion during the third quarter of the year, the bulk of activity will have finished by the end of the first quarter if the schedule is followed.

4.18
Peak demands for the various construction worker skill categories are reached during different stages of activity. For example, the peak demand for carpenters during Step I (fourth quarter of 1980) is reached prior to the peak need for bricklayers (second quarter of 1981). While the greatest requirements are concentrated during the second and third years of construction activity, estimates of annual demand for manpower based upon peak levels will differ from average annual needs.

4.19
The administrative personnel, listed in Table 4-5 required for the project were divided into two separate categories:

- U.S. Steel Personnel
- Other On-site Administration

U.S. Steel personnel consist primarily of supervisory construction engineers (approximately 70 percent of the total of this category for each year) and "operational" engineers -- approximately 20 percent of the total of this category for each year. (This group should <u>not</u> be

confused with the skill/operational category "operating engineers.") Remaining U.S. Steel employees are split equally between security personnel and medical personnel (five percent for each). "Other on-site administration" represents an aggregate of subcontractor employees. These are a mixture of engineering, drafting, clerical, and accounting personnel, plus supervisory staff sent in by subcontractors to oversee and be responsible for their portion of the construction work. Table 4-5 presents the scheduled requirements for these two personnel categories by year for each of the two steps of the project. As can be seen, approximately 80 percent of the total required U.S. Steel personnel are involved from the outset of the project during Step I, while the subcontractor personnel are scheduled to reflect the general progress of the project and the scheduled requirements for union-affiliated personnel. Most U.S. Steel personnel can be expected to join the project at the beginning whereas subcontractor employees do not peak until the third year of Step I. Step II scheduling is slightly different in that: U.S. Steel employees are scheduled to be involved in a pattern similar to overall construction progress during this step; and both categories of administrative personnel build up to a scheduled peak during the third year of construction activity.

Source of Construction Workers

4.20
Four basic supply categories of construction workers are defined:

Residents/Commuters

"Original Residents" - Workers living within the Principal Study Area prior to plant construction.

"Commuters" - Workers who travel daily from outside the Principal Study Area but within 100 driving miles.

In-Migrants

"Movers" - Workers who move with their families to the Principal Study Area on a permanent basis, and then commute daily from their new homes to the construction site. In effect, movers will have the same general socio-economic characteristics as original residents but incremental infrastructure requirements (housing, schools, etc.)

"Weeklies" - Workers who acquire temporary quarters within the Principal Study Area, but do not live there on a permanent basis. On weekends, these workers return to their permanent homes which are assumed to be outside of the 100-mile commuting distance.

4.21
Information describing and estimating the local construction labor pool was gathered and provided by union officials from the Building Trades Councils of Erie and Crawford Counties. They coordinated the flow of information from each union affiliated with construction trade activity in a three-State area (Ohio, Pennsylvania, and Western New York State). This information was verified and supplemented by telephone calls to business managers or elected officials of local unions. Other sources used for this purpose were industrial Contractors who work within the Principal Study Area, U.S. Steel's Department of Labor Relations, and a Legal Memorandum presented to the U.S. Atomic Energy Commission (NRC) by Cleveland Electric Illuminating Company in connection with an application assumes the proposed plant will be built using union-affiliated labor, so unions with jurisdiction over the construction site were contacted as a first step toward establishing the size of the labor pool that could be available to work at the site. In most cases, union membership in these locals would not be sufficient to fill the manpower requirements, especially for specific skill categories. Furthermore, the number of union members within these locals woud be to some extent irrelevant, since many of the members now work at permanent jobs (unrelated to construction) and would, therefore, be unavailable for employment on the construction project. For this reason, information was assembled in order to estimate the total labor pool within approximately 100 miles of the construction site.

a) Original Residents

4.22
A list of the union local representing major skill categories required by the project and having primary jurisdiction at the proposed plant construction site is presented in Table 4-6. As can be seen, many of the local unions are not based within the Principal Study Area, and most of the members of these unions do not live within the Principal Study Area. The situation is even more complex than the table might indicate, since many of the local unions are not only constituent members of an International Union which sets basic jurisdictional boundaries, but also are members of a local Building Trades Council which has broader de facto jurisdiction (in geographic terms) than some of the individual locals. For example, the local unions with offices in the city of Erie Building Trades Council(s) which have jurisdiction as far west as the Ohio/Pennsylvania border while some of the same individual craft locals (Ironworkers and Boilermakers for example) have jurisdiction which runs across the State line into Ashtabula County. The complexity of overlapping jurisdictional boundaries and potential for disputes caused by this has been recognized by the union leadership. A Joint Building Trades Council is now being formed to coordinate activities and policies

Table 4-6

Unions With Primary Jurisdiction Over the Proposed Lakefront Construction Site

Occupation Category	Location	Local No.	Permanent Membership	Presently Unemployed (1)	Estimated Availability (1977)
Laborers	Erie	603	600	40%	240
	Ashtabula	245	225	10%	20
Operating Engineers	Erie	66	1,500	50%	750
	Cleveland	18	2,600	10%	260
Carpenters	Erie	81	540	20%	110
	Cleveland	1571	5,700	15%	855
Millwrights	Cleveland	1871	375	30%	110
Ironworkers	Erie	348	464	40%	185
Bricklayers	Erie	28	200	30%	60
	Ashtabula	42	150	40%	60
Boilermakers	Cleveland	744	415	20%	80 (2)
Electricians	Erie	56	312	8%	25
	Ashtabula	762	124	15%	20
Pipefitters	Erie (3)	333	-	-	-
	Cleveland	120	1,732	28%	340

(1) Includes members who may be employed outside of union's jurisdictional area or within geographic area but outside of their principal skill category; e.g., a bricklayer or ironworker working as a laborer.

(2) There are 200 additional boilermakers who live in Coastal Communities between Erie and Cleveland and hold "international" union cards for this skill category but are not affiliated with a local union.

(3) Plumber and steamfitters local; belongs to same international union so would have jurisdiction but availability figures are irrelevant because plumbers cannot perform necessary pipefitter tasks.

Source: Erie Building Trades Council; personal interviews with local unions and contractors within the Principal Study Area; Arthur D. Little, Inc. estimates.

between the Erie and Cleveland Building Trades Councils. The last column of Table 4-6 presents estimates of the number of construction workers from union locals with primary jurisdiction who would likely be available for employment at the site in 1977. The basic methodology used in arriving at the estimates of the available labor pool both now and in the 1979-1982 period was as follows:

- To identify the numbers of those workers in the required skill categories who are now unemployed, and

- To compare conditions within the building trade industry at the present time with projections and estimates of conditions likely to prevail during the period in question.

In preparing these estimates, major projects now under construction or known to be "on the drawing board" for the time period during which the proposed plant would be built were reviewed, since these projects are likely to be competing for unionized construction workers within the same overall labor pool. Examples are the Perry Nuclear Power Plant near Perry, OH, scheduled for peak construction activity during the period 1980-1982, the proposed Pennsylvania Electric Plant (Coho No. 1) to be located in Girard, PA, which could begin construction in 1982, and the Lake Erie Generating Station in Dunkirk, NY, where construction is scheduled to begin in the Spring of 1979.

4.23
Table 4-7 presents for both Step I and Step II estimates of the number of original residents (workers presently living in communities within the Principal Study Area) who work on the Lakefront project for each year. Projections of the numbers of these workers who already reside within the Principal Study Area, who work on the Lakefront project for each year. Projections of the numbers of these workers who already reside within the Principal Study Area were made on the basis of:

- Personal interviews with local union officials,

- Interviews with several local Contractors,

- Estimations of baseline population data for the Principal Study Area, and

- Evaluation of the Coastal Communities within the Principal Study Area and their general social composition.

As can be seen in Table 4-7, a significant number of additional original residents are expected to be employed during the second year of

Table 4-7

Original Resident Construction Workers[1]
(Includes Administrative/Clerical Workers)

Year	Total (Including Admin.)
1979	1190 (50 Admin./Cler.)
1980	1600 (85 Admin./Cler.)
1981	1895 (105 Admin./Cler.)
1982	1285 (70 Admin./Cler.)
1984	500 (55 Admin./Cler.)
1985	1845 (105 Admin./Cler.)
1986	1855 (115 Admin./Cler.)
1987	790 (70 Admin./Cler.)

(1) These estimates represent the number of local resident construction workers at the peak of activity for each ear.

Source: Arthur D. Little, Inc. estimates based upon local union membership figures; manpower requirements supplied by U.S. Steel; the Principal Study Area population baseline data.

project construction activity (1980). The approximately 400 additional original residents during 1980 and the approximately 300 additional original in 1981 are expected to be the result of several of the local unions with primary jurisdiction at the site opening up their membership books for the purpose of employing local residents. Such unions may issue temporary "permit cards" allowing original residents to work under their jurisdiction but the cards are likely to be pulled back as the amount of construction and size of the workforce at the site decreases.

The same general rationale lies behind the projections that have been made for Step II of the proposed construction project with the exceptions that:

- A substantial proportion of movers in Step I will stay on as permanent residents, meaning that a larger pool of skilled workers will be available within the Principal Study Area for Step II and other non-related projects; and

- Residence patterns will have changed slightly -- especially within the Ohio Principal Study Area -- as communities further develop during five years of economic activity.

4.24
Table 4-8 shows original residents as a percentage of the total peak construction workforce for each year and the percentages of original residents who live in Ohio and in Pennsylvania. These data indicate a very large majority of the original residents are expected to be residents of Pennsylvania. This reflects the relative (large) size of Erie local unions and the fact that most of their members live in the Pennsylvania Principal Study Area. Within the Ohio Principal Study Area, Ashtabula and Painesville-based locals have considerably smaller membership enrollment and many of their members live beyond the boundaries of the Ohio Principal Study Area (between Saybrook Township and Cleveland, OH).

b) Commuters

4.25
It is clear that unions with primary jurisdiction cannot fill the manpower requirements in each skill category from their membership ranks. This will necessitate calling upon a larger labor pool. When a general Contractor or subcontractor undertakes an assignment he must work through the local union office which has primary jurisdiction over the site to obtain his required manpower. This is an accepted procedure in contemporary labor-management relationships within the construction industry. Local unions with primary jurisdiction will therefore be able to place all of their membership who

Table 4-8

Original Residents as a Percentage of Total Peak Manpower Requirements

	Original Residents	Total Peak Manpower Required	Percent Original Residents	Ohio Residents		Pennsylvania Residents	
				Number	Percent	Number	Percent
1979	1190	2950	40	285	24	905	76
1980	1600	8800	18	425	27	1175	73
1981	1895	10,500	18	595	31	1300	69
1982	1285	4500	29	355	28	930	72
1984	500	630	79	240	48	260	52
1985	1845	6000	31	700	36	1145	62
1986	1855	6600	28	700	38	1135	62
1987	790	1880	42	345	44	445	56

Note: These estimates represent the number of local resident construction workers at the peak of activity for each year.

Source: Arthur D. Little, Inc. estimates based upon union membership figures; manpower requirements supplied by U.S. Steel; population baseline figures.

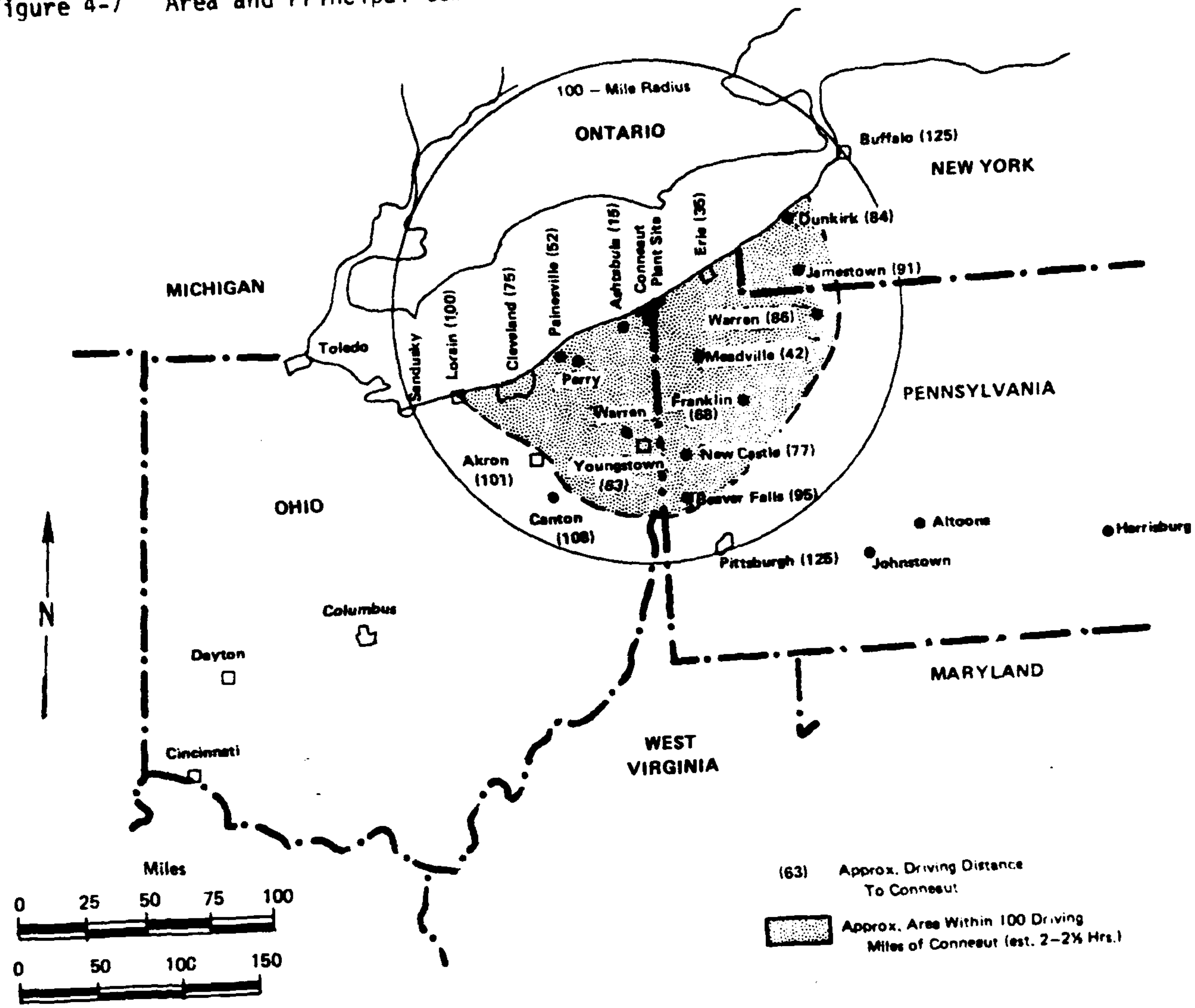
are available on the Lakefront project since they will have priority. As soon as this labor pool is exhausted (or nearly so) by requirements of the job, the normal procedure is to call upon the closest sister locals in the relevant craft who can supply members. The construction industry is characterized by extreme fluctuations in the demand for labor. However, the membership of local unions tends to remain very stable, with increased manpower brought in from adjoining areas when it is needed. The circle is expanded in this way until the required manpower level for each craft is filled.

4.26
In general, construction workers expect to commute substantial distances to their place of work each day. The nature of the work makes employment inherently temporary. When one job finishes, or is about to finish, a worker looks for another within feasible commuting distance. Workers in the construction trades accept this phenomenon. They spend much of their working lives on large scale projects far from their normal homes with members of several other local unions in their skill category (sister locals). Thus, cooperation and sharing out of available work on large projects between sister locals is a normal occurrence and should not prove to be a problem on the Lakefront project. Based upon discussions with union personnel, a "feasible commuting distance" was defined as approximately 100 road or driving miles from the construction site (refer to Figure 4-7). Major sources of labor, such as Youngstown and Cleveland, OH, and Dunkirk and Jamestown, NY, are within this 100-mile driving radius. If manpower requirements cannot be met from within this radius, it has been assumed that in-migrants will be needed, either weeklies or movers. It is expected that the majority of manpower requirements at the Lakefront facility will be filled by original residents or commuters during each year of construction activity. Table 4-9 reflects the total estimated labor pool available within 100 driving miles in the required skill categories and illustrates the breakdown between original residents and those original residents who live between 30 and 100 driving miles from the Lakefront site.

c) Balance of Supply and Demand: In-Migrants

4.27
The aggregate labor pool within 100 driving miles of the proposed Lakefront site is considerably larger than the aggregate manpower requirements (at the peak quarter of each year). However, the aggregate numbers represent an estimated oversupply in some of the individual skill categories (laborers, carpenters, bricklayers, and operating engineers) and a supply considerably less than required in other skill categories (millwrights, boilermakers, electricians, and pipefitters). There is one skill category - ironworkers - in which the supply and demand match up almost evenly with the exception of

Figure 4-7 Area and Principal Communities Within 100 Driving Miles of Conneaut



Source: Arthur D. Little, Inc. estimates based on highway maps

Table 4-9

Available Labor Pool

Year	Manpower Required	Original Residents	Commuters	Additional In-Migrants Required
1979	2,950	1,190	1,565	195
1980	8,800	1,600	4,840	2,360
1981	10,500	1,895	4,945	3,660
1982	4,500	1,285	2,220	995
1984	630	500	35	95
1985	6,000	1,845	2,835	1,320
1986	6,600	1,855	2,850	1,895
1987	1,880	790	760	330

Note: Estimates obtained from assessment of requirements/availability in each skill category.

Source: United States Steel Engineering Department; local union officials; Arthur D. Little, Inc. estimates.

the single peak year (1981) requirement. Union regulations and the job skills required of each of the categories in short supply mean that workers who originate considerably farther than 100 (driving) miles from the site will have to be brought in to fill the critical skill gap. The requirements for and estimated availability of manpower in those critical skill categories in short supply within feasible (100 driving miles) commuting distance are presented in Table 4-10. It also includes the number of U.S. Steel and subcontractor personnel who will move into the Principal Study Area. Table 4-11 shows the total number of in-migrants as a percentage of the total workforce for each year of both steps of the proposed project. As can be seen, the total number of in-migrants for Step I is estimated at 195 during the first year of the project, building to 2,360 in the second year, rising to a peak of 3,660 during the third year and then falling back to 995. In percentage terms, this represents seven percent of total workforce requirements in the first year, 27 percent in the second year, 35 percent in the third year, and 22 percent in the fourth year. For Step II, the in-migrants account for 15 percent of total employees during the first year, 22 percent during the second year, 29 percent for the third year, and 18 percent for the final year of construction. To measure the impact that such in-migration will have upon the Principal Study Area, it is necessary to estimate the proportion of the in-migrants who will be movers and those who will be weeklies. This information is summarized in Table 4-12.

Operations

4.28
The applicant provided data on the capacity, product mix, and manpower requirements of the proposed Lakefront Plant's operations phase during the period 1981-1990. Included was information on proposed training programs to be employed at and the likely number of U.S. Steel personnel to be transferred to the facility. Data were also provided on the purchasing patterns of operating materials/services requirements at three U.S. Steel facilities. These data were supplemented by the findings of several studies conducted by the applicant's consultant, information available in State/regional input-output tables, an analysis of marketing and purchasing patterns in the steel industry, and a review of the economic and industrial bases of the Regional Study Area and other economies of the North Central part of the United States. The information served as the basis for estimating the magnitude of likely secondary industrial development in the Regional Study Area generated primarily by the increase in population created by the new job opportunities. The share of the new job opportunities likely to be filled by present area residents was estimated based upon findings of previous studies and a review of the potential labor pool in the Regional Study Area.

Table 4-10

Requirements for and Availability of Critical Skill Categories and Administrative Personnel at the Proposed Lakefront Plant

	Step I (1979-1982)			Step II (1984-1987)		
	Work Force Required at Peak (1981)	Est. No. Available (1979)	Maximum Additional Needed	Work Force Required at Peak (1986)	Est. No. Available (1984)	Maximum Additional Needed
Ironworkers	1,650	1,100	550	800[(1)]	800	None
Millwrights	900	100	800	700	100	600
Boilermakers	700	150	550	500	100	400
Electricians	1,200	600	600	900	600	300
Pipefitters	1,500	700	800	1,000	700	300
On-Site Admin. (Subcontractors)	450	225	225	350	175	175
On-Site Admin. (U.S. Steel)	150	15	135	150	30	120
Total Work Force (all categories, including those not listed)	10,500	6,990	3,660	6,800	4,905	1,895
		10,650		6,600[(2)]	6,800	

(1) Peak requirement for Ironworkers during Step II actually occurs in 1985.

(2) The maximum number of workers needed during the peak quarter of each step is less than the total number of workers because of different peak quarters for some skill categories.

Source: Arthur D. Little, Inc. estimates based upon United States Steel Corporation data; material supplied by local union officials and construction trade employers' associations.

Table 4-11

In-Migrant Workers as a Percentage of the Total Work Force

Year	Manpower Requirements (1)	In-Migrants	Percent
Step I			
1979	2,950	195	7%
1980	8,800	2,360	27
1981	10,500	3,660	35
1982	4,500	995	22
Step II			
1984	630	95	15
1985	6,000	1,320	22
1986	6,600	1,895	29
1987	1,880	330	18

(1) at peak during year.

Source: Arthur D. Little, Inc. estimates.

Table 4-12

Summary of Allocations Between "Weekly" and "Mover" In-Migrants[1] (Step I and Step II)

Step I	Total Manpower Requiements	Total In-Migrants	Weeklies	% of Total Workforce	% of In-Migrants	Movers	% of Total Workforce	% of In-Migrants
1979	2,950	195	35	1%	18%	160	5%	82%
1980	8,800	2,360	1,350	15	57	1,010	11	43
1981	10,500	3,660	2,650	25	72	1,010	10	28
1982	4,500	995	360	8	36	635	14	64
Step II								
1984	630	95	30	5	32	65	10	68
1985	6,000	1,320	880	15	67	440	7	33
1986	6,600	1,895	1,400	21	74	495	8	26
1987	1,880	330	40	2	12	290	15	88

(1) Includes ironworkers, electricians, pipefitters, millwrights, and boilermakers among union-affiliated workers and both U.S. Steel and subcontractor administrative personnel.

Note: Percentage figures are rounded.

Source: U.S. Steel Engineering Department and Arthur D. Little, Inc. estimates based upon union manpower available and personal interviews with union officials and management personnel from contractor firms.

The corollary to this estimate was the number of workers likely to move into the Regional Study Area as a result of the Lakefront facility operations and related development. Unlike the construction workers, these in-migrant workers were all assumed to move into the Regional Study Area on a permanent basis, relocating their families, and establishing a new residence within the study area. These permanent new residents were distributed among the Coastal Communities and remainder of the Principal Study Area based upon a review of findings on prior studies dealing with residence preferences and the potential attractiveness of each community. The resulting increases in community population levels served as necessary input to estimating impacts upon local housing, tax, infrastructure, and related requirements. The remainder of this section focuses on a characterization of the construction and operations phases of the proposed Lakefront facility. This characterization is presented in terms of activity levels and schedules, facility manpower requirements, production and payroll levels, and sources of construction and operations workers. Related secondary industrial development and the impact upon social and economic parameters of various communities are discussed in other sections of the report.

Direct Operations Profile

Number of Workers

4.29
According to the applicant, the technology employed at the proposed facility represents the most advanced state-of-the-art in steelmaking. As a result, planned employment requirements per ton of rated capacity will be well below present steel industry averages. As the data in Table 4-13 indicate, operating employment at the facility is expected to reach almost 5,400 during Step I and 8,500 by Step II. These employment levels, when compared to the planned steelmaking capacity of each step, result in expected capacity (in thousands of tons per employee) ratios of 0.70 for Step I and 0.89 for Step II which are about double the present industry-wide average. This ratio relates the tons of steelmaking capacity, in thousands, to total steel industry employment and represents an industry-wide average. In this industry, such a measure is normally expressed in terms of man-hours per ton of finished steel shipped. However, because of significant product mix differentials within the industry and that of the proposed Lakefront facility, comparability based on such a measure was not possible. As a consequence of the high degree of automation at the proposed plant, training periods for all workers are expected to be conducted prior to the start up of production at each step. As construction of Step I capacity nears completion, training programs for the facility personnel will be conducted during the latter part of 1981 and the first three months of 1982.

Table 4-13

Occupation Mix of Facility Employment During Operations
(Percent of Total)

Occupation/Skill Category	Step I	Step II
Officers and Managers	9%	8 %
Professionals	1	1
Technicians	3	3
Office and Clerical Workers	11	10
Skilled Workers	40	40
Semi-skilled Workers	26	27
Unskilled Workers	8	9
Service Workers	2	2
	100%	100%

Source: United States Steel Corporation.

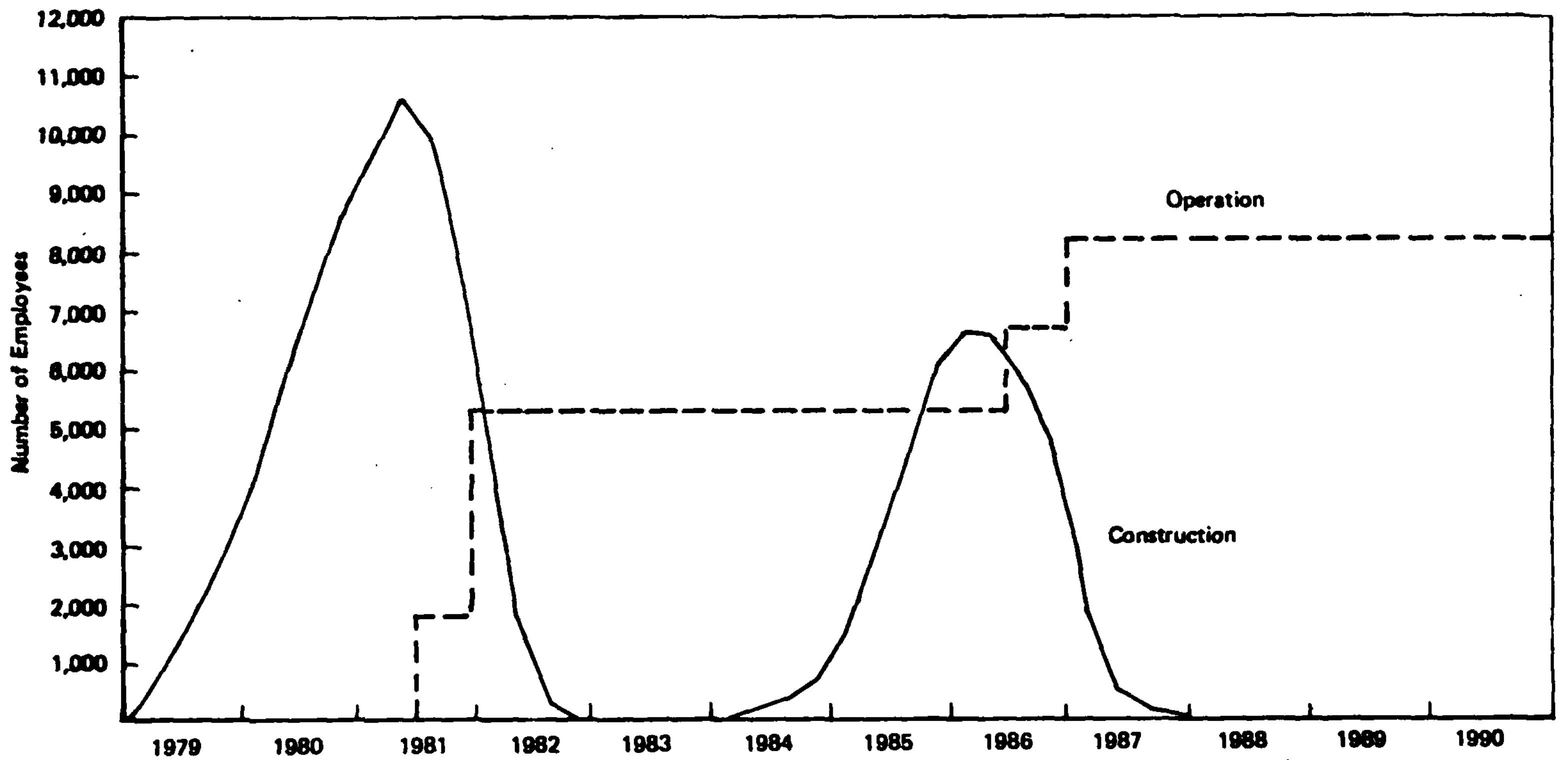
Similarly, during the latter part of Step II completion, most of the additional work force to be employed at the facility will undergo training. Figure 4-8 shows that the employment levels at the Lakefront facility move up in a step-wise fashion, reflecting the:

- Training of Step I personnel,
- Completion of Step I capacity,
- Training of additional personnel for Step II, and
- Completion of the additional Step II capacity.

Maximum total employment levels at the facility will be reached during the peak of Step II construction when about 6,600 construction workers and 5,400-6,000 operating personnel are on-site. Unlike Step I, construction during Step II will proceed along wtih actual production at the facility.

4.30
A breakdown of the operations work force by occupation or skill category is presented in Table 4-13. The majority of the facility's work force will be concentrated in the skilled and semi-skilled categories. Contributing to this concentration is the high number of maintenance related workers in the employment estimates. As a result of the high degree of plant automation, the number of employees associated with facility maintenance will be substantial. During Step I, approximately 44 percent of the total work force (about 2,400) will be accounted for by maintenance workers. In addition to these U.S. Steel maintenance workers, it is expected that an additional 350 maintenance personnel will be employed on-site by private establishments contracting for services with U.S. Steel. During Step II, the U.S. Steel maintenance work force is estimated at over 3,700 (included in the facility's total employment of nearly 8,500) and private-hired maintenance at over 500. During the initial months of facility start-up, probably in early 1982, it is likely that some experienced personnel at existing U.S. Steel steelmaking operations would be relocated to the proposed plant for two to three months. Since the actual number of such "borrowed" employment and its duration are unknown and difficult to estimate, it has been excluded from the data given on Table 4-14. Thus, the work force estimates on Table 4-14 represent permanent job requirements at the Lakefront facility. While the bulk of the workforce at the Lakefront facility would be male, it is assumed that a 20 percent female hiring objective will prevail. This policy was established by Consent Decree II (April 1974), an agreement among nine major steel companies and the Federal Government.

Figure 4-8 Projected Employment Levels at the Lakefront Project - 1979-1990



Source: United States Steel Corporation.

Table 4-14

Planned Employment at the Lakefront Facility During Operations

(Man-year Equivalents)

Year	Number of Employees[(1)]	Male	Female	Operations/ Training
1981	1,701	1,459	242	Step I Training
1982	5,381	4,431	950	Operations
1983	5,381	4,431	950	Operations
1984	5,381	4,431	950	Operations
1985	5,381	4,431	950	Operations
1986	6,324	5,240	1,084	Operations/Step II Training
1987	8,457	6,863	1,594	Operations
1988	8,457	6,863	1,594	Operations
1989	8,457	6,863	1,594	Operations
1990	8,457	6,863	1,594	Operations

(1) Excluding privately-contracted maintenance.

Source: United States Steel Corporation.

Transfer

4.31
The work force at the proposed facility is estimated at almost 5,400 by Step I, reaching close to 8,500 by Step II. As a result of the high degree of plant automation and complexity, it is expected that a number of present U.S. Steel employees will be transferred to the proposed facility as permanent workers. These employees will be recruited throughout U.S. Steel's organization and will bring the required skills and experience necessary for successful plant operation. It is estimated that approximately 20 percent of the total (Step II) work force at the proposed facility will be U.S. Steel transfers from other existing operations. As the data on Tables 4-15 and 4-16 indicate, about 1,675 employees will be transferred to the facility during Step I. Transfers will, therefore, represent about 31 percent of the facility work force during Step 1. With the addition of only 15 more transfers during Step II, this ratio falls to 20 percent. It should be noted that the data on Tables 4-15 and 4-16 represent best estimates and planned targets; reassessment of these targets will likely be necessary as operations schedules are finalized. Overall, however, the number of U.S. Steel transfers to the facility is expected to average around 20 percent of the total work force. As a result, over 3,700 jobs will be available for new hires during Step I, with about 3,000 additional positions opening with Step II. Thus, over 6,700 job openings will be available for new hires at the facility.

Training

4.32
It is the intent of U.S. Steel to maximize the employment of local residents at the facility. By giving first consideration for openings to be filled by new hires to original residents, U.S. Steel hopes to fill as many jobs as possible with original residents. To accomplish this objective, U.S. Steel is planning to implement a series of actions including the following:

- Place U.S. Steel personnel representatives on site at least 12 months prior to start-up,
- Advertise for job applications prior to start-up in local papers only,
- List all openings with the local offices of the Ohio and Pennsylvania Bureaus of Employment Security in seeking referral of local candidates,
- Accept applications for employment well ahead of actual start-up; and
- Promote preference for job applications from local residents by participation in meetings of local organizations, school, etc.

Table 4-15

U.S. Steel Transfers During Operation--Step I

Occupation/Skill Category	Work Force Male	Work Force Female	Work Force Total	Transfers-In Male	Transfers-In Female	Transfers-In Total	New Hires Male	New Hires Female	New Hires Total
Officers & Managers	485	5	490	485	5	490	-0-	-0-	-0-
Professionals	74	1	75	74	1	75	-0-	-0-	-0-
Technicians	155	27	182	58	7	65	97	20	117
Office & Clerical Workers	196	397	593	20	25	45	176	372	548
Skilled Workers	1,923	192	2,115	997	3	1,000	926	189	1,115
Semi-skilled Workers	1,150	236	1,386	-0-	-0-	-0-	1,150	236	1,386
Unskilled Workers	354	73	427	-0-	-0-	-0-	354	73	427
Service Workers	94	19	113	-0-	-0-	-0-	94	19	113
Total:	4,431	950	5,381	1,634	41	1,675	2,797	909	3,706

Source: United States Steel Corporation.

Table 4-16

U.S. Steel Transfers During Operations--Step II

Occupation/Skill Category	Increase in Work Force From Step I			Additional Transfers-In			Additional New Hires		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Officers & Managers	169	13	182	10	-0-	10	159	13	172
Professionals	33	2	35	5	-0-	5	28	2	30
Technicians	71	15	86	-0-	-0-	-0-	71	15	86
Office & Clerical Workers	89	189	278	-0-	-0-	-0-	89	189	278
Skilled Workers	1,015	208	1,223	-0-	-0-	-0-	1,015	208	1,223
Semi-skilled Workers	770	158	928	-0-	-0-	-0-	770	158	928
Unskilled Workers	262	54	316	-0-	-0-	-0-	262	54	316
Service Workers	23	5	28	-0-	-0-	-0-	23	5	28
Total:	2,432	644	3,076	15	-0-	15	2,417	644	3,061

Source: United States Steel Corporation.

The opportunities for utilizing present local residents in the proposed facility are increased further by the decision to put all newly hired personnel (and most of the U.S. Steel transfers) through a training program. Thus, it will not be necessary for most applicants to have any prior experience in steelmaking or related industries. However, the strong manufacturing orientation, especially in durable goods production, of the Regional Study Area's economy and labor force can be expected to be a positive factor in the effort to hire local residents. The training programs proposed will provide adequate classroom and on-site training, and will allow for promotion of early hires, especially as employment at the facility expands during Step II. As noted, training for Step I employees will be concentrated in the months prior to the start-up of operations. The length of training will vary depending upon skill category or responsibility. For some, the training period will be relatively brief, on the order of a few weeks. Many of the new hires for unskilled operating and maintenance and service workers positions will be put through a training program requiring only two to three weeks. On the other hand, an intensive 12-month program is being planned for new hires with the capability to become skilled craftsmen in one year. (Normally, craftsmen training requires three to four years.) Similar training programs are anticipated prior to Step II start-up.

Source of Operation Workers

4.33

Excluding U.S. Steel transfers, over 3,700 jobs will be available for new hires during Step I operation, with about 3,000 additional positions opening with Step II. Unlike the construction workforce, there is no organized supply source from which the potential operations manpower will be drawn. The workforce can be drawn from present labor force participants in the Regional Study Area and from candidates throughout the nation. The historical concentration of durable goods production, especially steelmaking, in the northcentral portion of the U.S. makes this area a likely source of supply of potential facility operating personnel. The approach used to estimate the number of job opportunities at the Lakefront facility likely to be filled by present residents of the Regional Study Area is presented in detail in the "Economics and Demographics Operations Phase Working Phase," a copy of which was appended to the draft Environmental Impact Statement. Elements addressed in the paper include the following:

- A review of several studies that have investigated the use of local labor during the operations phase of a major industrial development;

- A review of several efforts to develop quantitative models that would estimate the number of workers that will be supplied by local communities for the operations phase of a new development;
- A review of the experience at several developments of a similar magnitude, including U.S. Steel's Fairless Hills facility, Bethlehem's Burns Harbor complex, and General Motor's Lordstown plant;
- A review of the economic and labor force base in the Regional Study Area anticipated during the 1981-1990 period under baseline conditions; and
- A review of the training programs and hiring plans of U.S. Steel proposed for the Lakefront facility.

4.34
Based upon the factors outlined above, three alternative scenarios were proposed, with each employing a different level of original resident workers at the Lakefront facility. Under Step I operations, exclusive of U.S. Steel transfers, the percentage of the operations workforce likely to be filled by residents of the Regional Study Area ranges from a low of 50 percent to a high of 100 percent, with an intermediate estimate at 75 percent. Of the additional 3,000 workers to be added with Step II capacity, about 50 percent are assumed to be original residents under the intermediate scenario. The range incorporates a high of 70 percent and a low of 40 percent. The implicit lower percentage for Step II additional workers appears reasonable in light of:

- The Regional Study Area's limited employment base,
- Intentions to maximize local hires immediately, and
- The presence of much steelmaking activity within relatively close proximity of the Lakefront Plant.

4.35
When compared with total facility employment, original residents are expected to represent about one-half of the plant's workforce during both Steps I and II. Thus about 2,700 and 4,200 jobs at the facility will likely be filled by present area residents during Steps I and II operations respectively under the intermediate scenario. Under the alternative high estimate scenario, the corresponding employment levels for original residents are 3,700 and 6,000; under the low scenario, the levels are 1,800 and 2,800.

4.36
The remaining jobs will likely be filled by workers who will migrate into the Regional Study Area. In doing so, they are likely to bring along their spouse and children, thus creating new households and

raising population in the area. Based upon prior experience in similar developments, such in-migrants may indeed commute to the Lakefront Plant during their initial period of employment. However, it is likely that they would essentially relocate to the Regional Study Area on a permanent basis.

Regional Economic Impact

4.37
The secondary impacts resulting from the projected direct, indirect, and induced activity economically linked to the proposed Lakefront Plant are evaluated in this section. It is important to note that the location of any major industrial facility of the size of the Lakefront Plant in such a relatively rural area could have other economic impacts not quantified in this report. These effects would be due to the "positive growth" ethic reflected by such a locational choice by a major company, and its acceptance by local, State, and Federal review and planning agencies. State, county, and local industrial promotion activities aimed at attracting manufacturing or service entities which are unlinked to the proposed Lakefront Plant must be evaluated independently.

4.38
The projected magnitude of secondary growth in this report is strongly linked to the product mix of the proposed plant. It is possible that at some point in the future, beyond the projection period considered here (1990), expansion of the steelmaking facility and its product mix would be considered. A broader finished product mix would be expected to result in larger growth potential in economically linked industrial sectors than that associated with the present proposal. However, any plans for expansion so far in the future are entirely speculative at this time. While such expansion might theoretically be considered a "secondary impact" of this proposed project (as the proposed project might be considered a secondary impact of the available port and raw materials supply infrastrucure in Conneaut), the economic and environmental effects of such expansion could only be realistically evaluated at the time plans were actually under consideration.

4.39
The applicant has studied the potential effect that the proposed Lakefront plant might have on manufacturing facilities within its own organization. Preliminary indications are that the proposed plant will have no adverse effect on these installations. Further, it is the view of the applicant that production at the proposed plant will, through interplant shipments of hot bands for further processing, permit better utilization of existing finishing mill capacities within economic shipping distances and within the primary product

market area. If other United States Steel Corporation plants are closed, or certain operations within existing plants are discontinued, it is expected that such decisions will be made largely on the basis of local plant profitability, and that the existence or lack of existence of the proposed Lakefront Plant will have little influence on such profitability analyses.

Secondary Economic Activity

a) Indirect Activity

4.40
The indirect economic impacts of the Lakefront Plant are defined in terms of the business volume, employment, and payrolls generated by customer purchases from or supplier sales to the facility during both the construction and operations phases. It is not likely that major users of steel mill products would relocate or establish new facilities in the Regional Study Area. The applicant estimates that of the 3.3 million tons of steel sheet produced annually during Step I and the 4.9 million tons produced during Step II, about 40 percent will be shipped to other U.S. Steel facilities for further processing into cold-rolled and coated products. Shipment of the remaining plant product will be accomplished using the existing rail and highway transportation system. Although it is possible that some steel-consuming industries (i.e., shipbuilding or railroad car manufacturers) might eventually locate in the Regional Study Area, this would most probably be a long-term development, occurring some 10-15 years after the plant is in full operation.

4.41
The proposed plant would generate a fairly large amount of expenditures for its daily operating needs (i.e., materials and services operating inputs). A portion of these expenditures would likely be made to supplier industries already in the Regional Study Area or expected to relocate to the Area. The applicant expects that the facility would generate an annual maximum of about $20 million (in 1975 dollars) in purchases during the construction phase and about $55 million during the operations phase from suppliers within the Regional Study Area. These purchases would represent only a small portion (less than 10 percent) of all Lakefront Plant expenditures.

4.42
The majority of the purchases made during the construction phase within the Regional Study Area would be in the stone, clay, and glass industry, which would provide brick, concrete, gravel, and other construction materials. The bulk of these materials would probably be purchased from major suppliers outside the area and brought to the site by railroad. Stone, clay, and glass purchases in the Regional

Study Area are expected to represent materials needed in relatively small quantities or on short notice and such purchases would most likely be made from suppliers in the Erie City area. The remaining construction purchases would be in the wholesale/retail trade sector, which would supply many different construction materials in small quantities (small hardware items, repair parts for equipment, etc.) These wholesale purchases are expected to be made from established firms in Conneaut, Ashtabula City, and Erie. The applicant's construction division anticipates most construction-related purchases would be made outside of the Regional Study Area from established large-scale suppliers.

4.43
The operations-related purchases in the Regional Study Area are estimated to represent 8-10 percent of total annual plant purchases of materials, supplies, and services. These are expected to be greater in divesity and dollar volume than construction-related purchases. Overall, the largest component of operations-related expenditures (approximately 40 percent) would be for maintenance work subcontracted to private firms. Although some 45 percent of the direct employees are expected to be involved with facility and equipment maintenance, U.S. Steel also plans to purchase selected maintenance services from outside private Contractors. The number of new job opportunities created by private maintenance services is estimated to be about 350 during Step I and 530 during Step II. The second largest component of operations-related indirect activity would be associated with an independently owned slag processing operation expected to be located on the plant site. This activity is expected to employ about 75 workers during Step I, rising to 125 workers during Step II. Other indirect manufacturing activities likely to expand or locate in the Regional Study Area as a result of Lakefront Plant development include producers of industrial gases, miscellaneous chemicals, small electrical equipment items, repair parts, etc. Although many of these are already established in the area new firms could locate throughout the Regional Study Area.

4.44
Facility expenditures in non-manufacturing activities would occur in the transportation services, wholesale/retail trade, and services sectors. Transportation services would include increased activity at the P&C Dock Company and B&LE Railroad for materials handling and product shipment, as well as the use of some local trucking firms to transport materials and equipment purchased in the Regional Study Area. The wholesale/retail trade sector would include purchases of relatively small quantities of numerous items such as office supplies and hardware items, as well as purchases of steelmaking supplies such as refractory brick, lubricants, and repair parts from warehousing operations which are likely to be established in the Local Study

Area. Purchases in the services sector would include repair services for plant equipment from existing firms, as well as from possible new firms established specifically for the repair and overhaul of steelmaking equipment.

b) *Induced Activity*

4.45
Induced activity is created by consumer spending of payrolls generated through direct and indirect employment. The amount of these consumer expenditures is a function of both the economic structure of the area (i.e., the number and type of establishments able to provide various consumer items) and the share of total payroll generated in the area which is expected to be spent in the area. Approximately two-thirds of all consumer-related expenditures would be made in the wholesale retail trade sector. The majority of this activity will likely occur in the established commercial centers of Conneaut, Ashtabula City, Millcreek Township, and Erie, although all communities would experience some increases in retail sales, such as food stores, gas stations, drug stores, etc. The second largest component of induced expenditures (approximately nine percent) is estimated to be in the selected services sector (personal services, household repairs), which would likely be distributed geographically in the same manner as wholesale/retail trade. Some five percent of consumer expenditures are estimated to fall in the finance, insurnace, and real estate (FIRE) sector, with the majority of the activity occurring in the established commercial centers. Other non-manufacturing activities (transportation, communications, utilities, construction, and agriculture/mining) are estimated to account for an additional 14 percent of induced activity. Less than three percent of consumer-related expenditures are estimated to accrue to manufacturing industries established in the Regional Study Area.

c) Other Employment

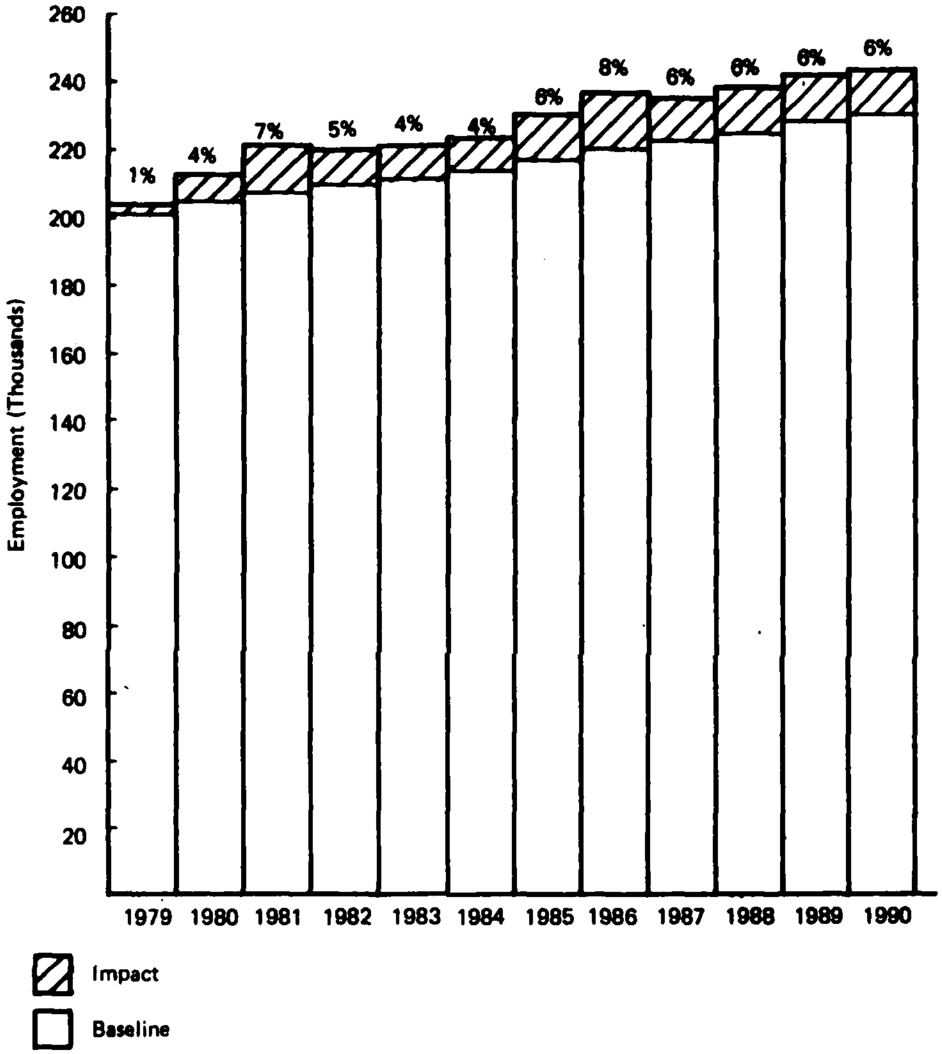
4.46
An additional component of employment and payrolls has even estimated based on plant-related infrastructure and population increases rather than consumer spending. This includes infrastructure construction (housing, schools, and sewers), Government employment (teachers, police, and firemen), medical services (doctors, dentists, and hospital workers), and other miscellaneous employment (e.g. operating labor for water and sewage treatment facilities).

Employment

a) Regional Study Area

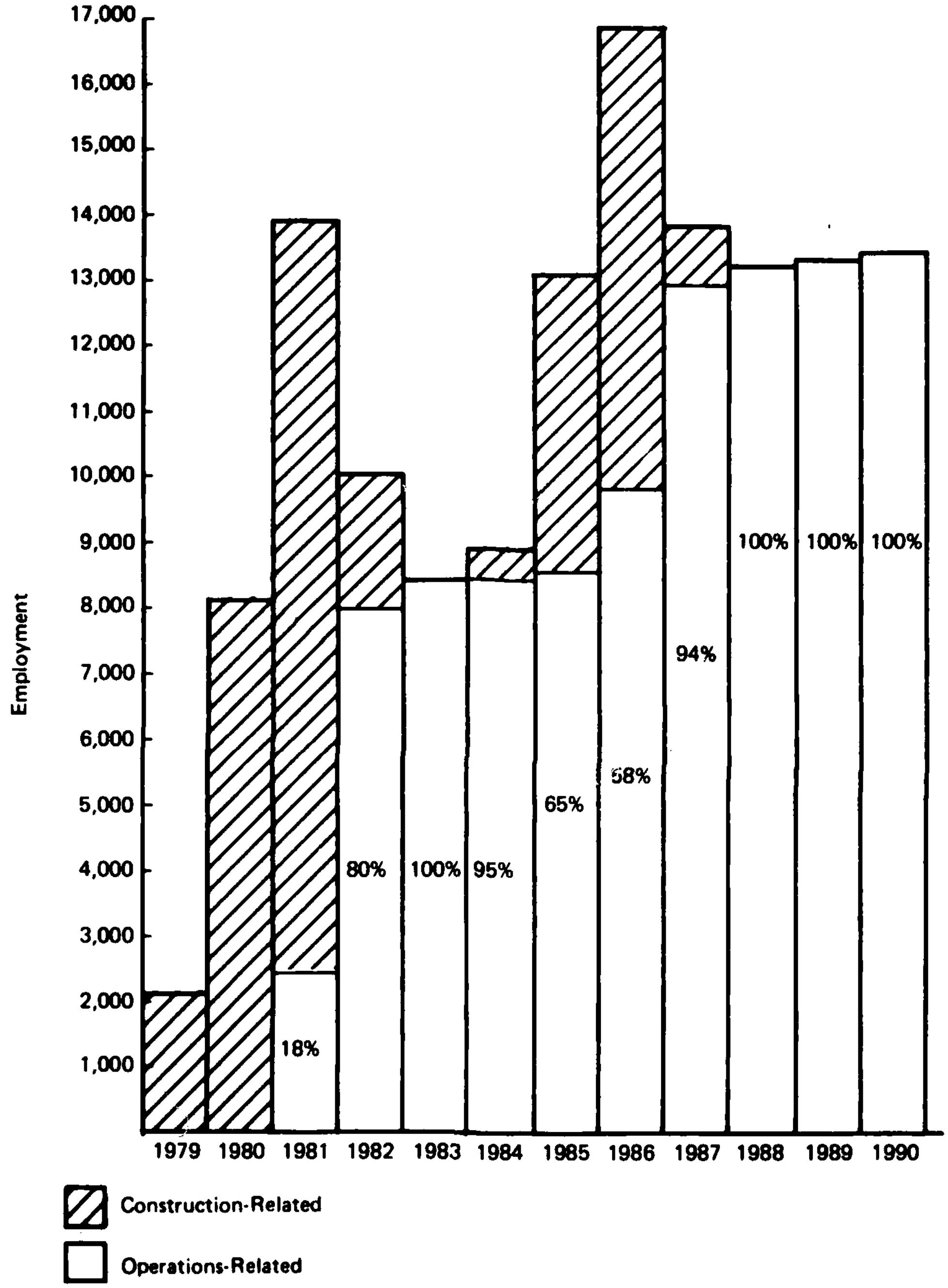
4.47
The total employment impact of the Lakefront facility and related secondary development on the Regional Study Area is estimated in 1990 to be approximately 13,400 jobs of which 8,450 are directly attributable to plant operations. The additional 4,950 jobs are the result of the indirect effects of plant purchases and the induced effects of increased payroll spending in the area. Ninety percent of these secondary jobs are expected to be in non-manufacturing sectors, in particular wholesale/retail trade. The estimated 13,400 jobs generated represent approximately six percent and eight percent of the projected 1990 baseline levels of employment in the Regional Study Area and the combined two-State Principal Study Area, respectively. The projected baseline and estimated total employment impacts in the Regional Study Area are shown in Figure 4-9. Throughout the projection period the employment impact represents between four percent and eight percent of the baseline level of employment. During the early years, the employment impact is generated primarily by construction activity. In 1981 and 1986, there is substantial construction activity in conjunction with operations activity, resulting in a total employment impact equal to or greater than the long-term impacts. In 1986, new employment is estimated to be approximately 16,900 jobs or almost eight percent of the baseline regional projection.

4.48
Employment levels generated by both the construction and operation of the plant are depicted separately in Figure 4-10. This figure also illustrates the large fluctuations in the total employment which take place during the construction periods. For example, during 1979, there are only 2,050 jobs generated in the area, but by 1981 there are approximately 13,900 job opportunities, of which over 11,000 are either directly or indirectly related to the construction activity. Since Step I; construction activity will have terminated, there is expected to be no construction-related employment in 1983. Construction activity from 1984-1987 (Step II), while similar to the 1979-1982 pattern, proceeds on a somewhat smaller scale. The employment gains in operations activity during the latter period more than offset the construction losses from Step I as a result, total employment is higher during the second phase. In 1987, when facility construction is completed, the total employment impact resulting from the operations of the plant is expected to stabilize at around 13,400 jobs. Direct and secondary employment impacts from construction and operations activity for selected years are shown in Table 4-17. The 1990 operations employment multiplier (i.e., the ratio of secondary



Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

FIGURE 4-9 EMPLOYMENT IMPACTS IN THE REGIONAL STUDY AREA



Source: Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

FIGURE 4–10 EMPLOYMENT INCREASES IN THE REGIONAL STUDY AREA

Table 4-17

Total Employment Projections for the Regional Study Area -- 1979-1990
(Thousands)

	1979[1]	1981			1986			1990[1]
	Total	Construction	Operation	Total	Construction	Operation	Total	Total
Employment								
Impact	2.1	11.4	2.5	13.9	7.2	9.7	16.9	13.4
Direct	1.5	9.4	1.7	11.1	5.8	6.3	12.1	8.5
Secondary	0.5	2.0	0.8	2.8	1.4	3.4	4.8	4.9
Indirect	0.0	0.4	0.0	0.4	0.3	0.8	1.1	1.3
Induced	0.5	1.5	0.8	2.4	1.1	2.6	3.7	3.6
Baseline	200.9	207.5	207.5	207.5	220.1	220.1	220.1	230.4
Total Impact as a Percent of Baseline	1.0%	5.4%	1.2%	6.7%	3.2%	4.3%	7.6%	5.7%

(1) In 1979, employment impacts are only construction-related, whereas in 1990 employment impacts are only operations-related.

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

employment to direct employment) is slightly larger than 0.5 and considerably larger than the construction multiplier. The relatively small area construction multiplier is primarily the result of significant direct payroll leakages out of the Regional Study Area. In brief, there is not a large enough construction labor force available in the Regional Study Area to meet Lakefront Plant construction needs; therefore, a significant percentage of the construction jobs is expected to be filled by workers from outside the Regional Study Area.

4.49
Indirect impacts (i.e., generated from plant purchases) are not only relatively small, but are substantially less than the induced impacts indicating that a major build-up of area industry to supply the plant is not expected. The primary reason for the relatively small indirect impacts is the limited size and diversity of the industrial base and geographic locale of the Regional Study Area. The construction of the plant is expected to generate an even smaller amount of indirect activity because a large proportion of machinery and equipment purchases would be made from established suppliers outside the area. Local indirect activity would be generated primarily through purchases of small amounts of gravel, etc. (in terms of total requirements) from stone, clay, and glass industries in the area. During the peak construction years, purchases from this sector could stimulate the creation of an additional 200-300 jobs.

4.50
The induced employment impacts that would be generated by the direct and indirect payroll spending should comprise approximately 80 percent of the secondary impacts. These would occur primarily in the commercial sectors, with 1,700 jobs created in the area of wholesale/retail trade and 500 positions in selected services. The remainder of the induced employment is generated in such population-serving sectors as government (400 positions), medical (200 positions), FIRE (125 positions), and communications and utilities (225 positions). The induced activity, unlike the indirect activity, would likely be dispersed throughout the Regional Study Area with pockets of concentration in the urban centers of Conneaut, Ashtabula City, Millcreek, and Erie.

4.51
The employment impacts associated with construction activity are considered to be temporary. Therefore, the 1,400 secondary jobs created in 1986 as the result of construction activity are essentially not considered to exist beyond 1986. In reality a large number of these jobs would not be eliminated because the increase in operations employment in 1987 would sufficiently stimulate secondary activity such that overall secondary employment would actually

increase. There could be some employment dislocations in that the post-1986 increases would not completely occur in regions or economic sectors which were benefiting from construction-related activities. However, these effects are expected to be small, especially in the non-manufacturing sectors.

4.52
By 1990, the effect on the employment distribution of the area economy would be a slight shift, relative to the baseline projection, toward a greater manufacturing orientation. In 1990, under the baseline scenario, manufacturing employment is projected to comprise approximately 37 percent of Regional Study Area employment -- down from 39 percent in 1970. If the proposed plant is built, about 9,000 of the 13,400 new jobs would be in the manufacturing sector which by 1990 would comprise 38 percent of total area employment.

b) Estimated Employment Split Between Ohio and Pennsylvania

4.53
Estimates of employment increases within the Regional Study Area are presented in Table 4-18 with direct employment in the Ohio and Pennsylvania Regional Study Areas being entirely within Conneaut and Springfield. The proposed layout of the plant facilities suggests that approximately three percent of the operations workers would be working in Conneaut and the remaining 70 percent in Springfield. The relative distribution of construction workers between Conneaut and Springfield, however, varies significantly from year to year based on the proposed plant layout and construction schedule. Unlike direct employment, secondary employment activity is estimated to be fairly evenly distributed between the two States. Given the much smaller economic base in the Ohio Regional Study Area, this implies that the secondary impact would be relatively larger than in the Pennsylvania Regional Study Area.

c) Ohio Local Study Area

4.54
The potential impact of the Lakefront Plant on the Ohio Local Study Area economy could be quite large. As stated previously, Conneaut is expected to obtain approximately 30 percent to 40 percent of the direct employment. This, alone, would be a substantial impact on the local economy. However, the city is likely to also receive significant secondary growth which is expected to accentuate the relative employment gains within the community. The estimated plant related employment impacts on the Local Study Area are compared to the projected baseline in Table 4-19. By 1990, the total employment increase in the Ohio Local Study Area is estimated to be about 4,300 jobs, which is about one-third of the total Regional Study Area

Table 4-18

Employment Increases in the Regional Study Area -- 1979-1990
(Thousands)

	1979		1981		1986		1990	
	Employment	%	Employment	%	Employment	%	Employment	%
Direct Employment								
Total Regional Study Area[(1)]	1.5	100%	11.1	100%	12.2	100%	8.5	100%
Ohio Regional Study Area	0.5	33	4.5	41	4.7	39	2.6	31
Pennsylvania Regional Study Area	1.0	67	6.6	59	7.5	61	5.9	69
Secondary Employment								
Total Regional Study Area	0.5	100	2.8	100	4.6	100	4.9	100
Ohio Regional Study Area	0.3	60	1.3	46	2.3	50	2.5	51
Pennsylvania Regional Study Area	0.2	40	1.5	54	2.3	50	2.4	49
Total Employment								
Total Regional Study Area	2.1	100	13.9	100	16.8	100	13.4	100
Ohio Regional Study Area	0.8	40	5.7	41	7.0	42	5.1	38
Pennsylvania Regional Study Area	1.2	60	8.2	59	9.8	58	8.3	62

(1) Totals may not add due to rounding.

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-19

Estimated Employment Impacts in the Ohio Local Study Area -- 1979-1990

	1979	1981	1986	1990
Direct Employment				
Manufacturing	-	535	1980	2590
Construction	525	3940	2680	-
Total	525	4475	4660	2590
Indirect Employment				
Manufacturing	-	-	-	-
Non-Manufacturing	-	25	375	600
Population Serving[1]	-	25	75	125
Other[2]	-	-	300	475
Total	-	25	375	600
Induced Impacts				
Manufacturing	-	-	-	-
Non-Manufacturing	125	575	1000	1075
Population Serving[1]	75	475	875	1025
Other[2]	50	100	125	50
Total	125	575	1000	1075
Total Impact	650	5075	6035	4265
Total Baseline	5800	5990	6370	6670
% Total Impact	11%	84%	95%	64%
% Secondary Impact[3]	2%	11%	22%	25%

(1) Includes wholesale and retail trade; F.I.R.E.; communications; utilities; government; and selected services.

(2) Other includes transportation and construction.

(3) Secondary includes indirect and induced.

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

increase. Approximately 75 percent (3,200 jobs) of the employment increase would be directly or indirectly related to plant operations. The direct impact consists of about 2,600 operations workers on the Conneaut side of the Lakefront Plant site. The indirect impact would be in maintenance construction (270 positions), transportation services (200 positions), and wholesale/retail trade (125 positions, half of which are in food service at the plant). Indirect employment impacts in maintenance, construction, and food services would occur on the plant site well away from the Conneaut business district.

4.55
The induced employment impacts are estimated to be approximately 1,100 jobs by the late 1980's. This activity would be primarily in wholesale/retail trade (500 positions) and selected services (125 positions). Other sectors which are expected to receive significant increases in employment are government (200 positions) and medical (75 positions). The increase in government employment is expected to be primarily in education. Prior to the completion of plant construction, the total plant-related employment in Conneaut would be greater, given the significant direct construction employment during this period. For instance, in the peak construction years 1981 and 1986, the direct employment impacts are larger than the total 1990 employment increases. Secondary employment in 1990 is expected to be larger relative to short-run increases because the indirect local construction impacts are relatively small in comparison to operations impacts. Additionally, induced construction-related employment is relatively small because of the significant construction payroll leakages. During the early years of Steps I and II, however, there would be considerably more infrastructure construction activity, especially for housing. For the most part, this infrastructure should be in place prior to the actual needs; therefore, the induced construction labor impacts are expected to average from 50-100 more people per year in the early 1980's than in the late 1980's. Conneaut is not expected to surpass Ashtabula City as the commercial center of Ashtabula County, but it is expected to increase its relative share of county commercial activity. Employment in the population-serving sectors is estimated to increase by approximately 1,100 in the late 1980's. This represents a 35 percent increase above the projected baseline employment in these sectors.

4.56
The secondary employment estimates in combination with the infrastructure requirements suggest that the Conneaut shopping district is likely to expand along the major arteries running into

the city (Routes 20 and 7), but this would not occur on a large scale for the following reasons:

- Conneaut would gain a relatively large share of the estimated total new commercial activity, but because of the proximity of Ashtabula, Millcreek, and Erie, expected economic need for a large commercial buildup in Conneaut is not considered to be great.

- Many of the workers employed in Conneaut City would not necessarily live there. Thus, their expenditures would occur primarily outside Conneaut nearer their place of residence.

- The combined baseline and plant-related population in Conneaut would be significantly less than Millcreek's present population, which indicates that there would be no economic incentive for a major regional shopping center development.

The increase in local economic activity and the large labor force at the plant would likely result in a considerably higher traffic flow throughout the Conneaut area. The substantial increase in traffic flow can be expected to generate a demand for drive-in establishments, such as fast-food restaurants, which would tend to further accentuate the potential for "sprawl" development, if not adequately controlled through zoning ordinances.

d) Ohio Principal Study Area

4.57
The total employment increase associated with the Lakefront Plant and related development in the Ohio Principal Study Area is estimated to be 5,125 jobs by 1990. This would represent 14 percent of the projected baseline. Employment would be concentrated around Conneaut and, to a lesser extent, Ashtabula City. The suburban Coastal Communities are expected to essentially retain their "bedroom" community environment. However, increased economic activity is expected to occur in the form of new and expanded small retail establishments, such as gas stations, food stores, and pharmacies, to serve the new population. Estimates of the secondary employment increases for selected communities in the Ohio Principal Study Area are presented in Table 4-20. This table does not include the direct employment impact (2,600 in 1990) because most of it would occur in Conneaut and would distort the data on distribution of secondary employment. A sectoral breakdown of the total employment increase estimated to be generated in the Ohio Principal Study Area, inclusive of the Lakefront Plant, is presented in Table 4-21.

Table 4-20

New Secondary Employment in the Ohio Principal Study Area -- 1979-1990

	1979		1981		1986		1990	
	Commercial[1]	Total	Commercial[1]	Total	Commercial[1]	Total	Commercial[1]	Total
Ohio Principal Study Area	115	250	750	1250	1275	2300	1325	2525
Conneaut	75	125	425	600	750	1375	800	1675
Ashtabula City	25	50	225	350	375	650	375	625
Other[2]	15	75	100	300	150	275	150	225

(1) Includes employment in wholesale/retail trade, F.I.R.E., and selected services.

(2) Kingsville Township and Village, Ashtabula Township, Saybrook Township, and the rest of the Ohio Principal Study Area.

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-21

Employment Impacts Compared to Baseline Projections in the Ohio Principal Study Area -- 1979-1990

	1979 Impact	1979 Baseline	1979 % Impact	1981 Impact	1981 Baseline	1981 % Impact	1986 Impact	1986 Baseline	1986 % Impact	1990 Impact	1990 Baseline	1990 % Impact
Total Employment	775	30,835	3%	5715	31,890	18%	6945	33,765	21%	5125	35,680	14%
Manufacturing	*	12,800	*	550	13,350	4	2030	13,800	15	2675	14,150	19
Primary Metals	*	1,460	*	535	1,600	33	1975	1,640	120	2600	1,675	155
Other	*	11,320	*	15	11,750	*	55	12,160	*	75	12,475	1
Non-Manufacturing	775	18,035	4	5165	18,540	28	4915	19,965	24	2450	21,530	11
Wholesale/Retail Trade	90	5,925	2	525	6,075	9	975	6,550	15	1000	6,925	14
Selected Services(1)	25	4,775	1	265	4,975	5	400	5,675	7	475	6,250	8
Transportation, Communication and Utilities	10	3,000	*	100	3,050	3	290	3,150	9	400	3,250	12
Construction	625	1,125	56	4200	1,175	357	3050	1,275	239	275	1,355	8
Government	*	2,675	*	75	2,750	3	175	2,850	6	275	3,325	8
Agriculture/Mining	*	535	*	*	515	*	25	465	*	25	425	6

*Negligible

(1) Includes F.I.R.E., selected services, medical services, and private education.

Source: Regional Economic Structure baseline, Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

4.58
Secondary employment will rise to about 2,500 jobs in the Ohio Principal Study Area by the late 1980's. Approximately two-thirds (66 percent) of this employment is estimated to be in Conneaut, one-fourth (25 percent) in Ashtabula City, and the remainder (9 percent) dispersed throughout the area. Conneaut is expected to receive the majority of the secondary employment for the following reasons. One, most of the area's indirect employment would be at the plant site in Conneaut. Two, given Conneaut's position with respect to the worker population, it would receive a substantial share of the induced activity. Ashtabula City is also expected to receive a large share of the induced activity because of its proximity to the worker population and its relatively large existing commercial base. The majority of the secondary employment impacts are expected in wholesale/retail trade, FIRE, and selected services (refer to Table 4-21). The Conneaut commercial sector would be expected to expand to meet the demands of the increased area population. Ashtabula City can also expect an expansion in commercial establishments, though not nearly to the same extent as in Conneaut, for a variety of reasons. One, the Ashtabula City commercial sector is substantially larger than Conneaut and, therefore, can more readily absorb increased business volume without the necessity of significant facility expansion. Two, unlike Conneaut, there is limited open land available for additional commercial activity. Commercial activity in the suburban towns would also increase, but this activity would be widely dispersed. Small-scale shopping facilities, consisting of two to four stores, are likely. Residents of these communities are expected to continue to do their major shopping in Ashtabula City, Millcreek, and Erie.

4.59
During the early years of Steps I and II, there would also be relatively substantial construction activity for housing and commercial establishments. This activity would fluctuate, especially housing construction, in accordance with the influx of new population. In 1981, infrastructure construction employment (i.e., tertiary activity) is estimated to peak at about 250 construction jobs, while in other years it is estimated to range between 50 and 150. Government employment is another sector which is estimated to increase, principally as a result of new population. The employment impact is projected to be approximately 275 jobs by 1990, of which over 70 percent are education-related. Almost all of the educational employment increase is expected to occur in Conneaut and the surrounding suburban school districts. Most of the area economic sectors are expected to receive a significant impact on a relative basis with respect to employment generation as shown in Table 4-21. Primary metals and construction would receive the largest impacts in absolute, as well as relative, terms. As stated previously, wholesale/retail trade activity would increase substantially in the

area. The 1990 employment increase of 1,000 jobs in this sector represents 14 percent of the 1990 projected baseline level. There is expected to be very little manufacturing activity generated in the Ohio Principal Study Area other than the jobs at the plant. For example, by 1990, there are estimated to be about 75 new manufacturing jobs, primarily in nondurable goods production (e.g., chemicals) at plants located in Ashtabula City. The employment impacts in the transportation, communication, and utilities sectors (400 positions by 1990) represent 12 percent of the 1990 projected baseline. The majority of this increase would occur in transportation services, as a result of the increased traffic entering the area to supply the plant.

e) Pennsylvania Local Study Area

4.60
Springfield is a small rural community with minimal economic activity presently occurring within its boundaries. Due to the proximity of economic centers in Conneaut, Millcreek, and Erie, significant induced economic development is not expected to occur in this community. This does not mean that the community would be economically unaffected by the presence of the Lakefront Plant, but that employment impact is expected to consist almost entirely of the direct and indirect employment occurring on the plant site. The estimated plant-related employment impacts to be generated in the Pennsylvania Local Study Area are presented in Table 4-22. Total direct employment on the Springfield side of the plant site is estimated to peak at 7,500 in 1986, leveling off to 5,865 during the late 1980's. In addition to this employment, another 300-500 jobs would be created at the site by the maintenance and slag processing operations. This large workforce in the northwest corner of the town is expected to generate significant traffic flow, with most expected to be on the interstate away from residential areas.

4.61
Some build-up in Springfield's commercial activity is anticipated; however, the magnitude of this development is not expected to be great enough to attract shoppers from surrounding communities. Expansion would be the result of the anticipated increase in the town's population. Town residents, nonetheless, are expected to continue to carry out their major shopping at the Millcreek Mall and in Conneaut. Commercial employment in the town is estimated to increase by approximately 75 jobs, which is less than 10 percent of the increase estimated for Conneaut. Government employment is expected to increase with the rise in population, but most of this new employment is estimated to be school-related. As with the other communities in the area, infrastructure construction activity would be required during the early years of Steps I and II. This activity

Table 4-22

Estimated Employment in the Pennsylvania Local Study Area -- 1979-1990

	1979	1981	1986	1990
Direct Employment				
Operations	-	1175	4350	5865
Construction	1025	5450	3150	-
Total	1025	6625	7500	5865
Indirect Employment				
Maintenance Construction			180	270
Slag Processing	-	-	125	225
Total			305	495
Induced Employment				
Commercial (1)	10	50	75	75
Government	-	10	35	50
Construction	-	50	50	-
Total	10	110	160	125
Total Employment	1035	6735	7965	6485

(1) Includes wholesale/retail trade, F.I.R.E., and selected services.

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers, SIMPACT IV Model.

would generate an additional 25-75 jobs annually in Springfield during these periods with most of the activity expected to be housing-related. The current zoning ordinance allocates only a small share of the township's land to commercial uses. Furthermore, the lack of sewer and water supply infrastructure in Springfield would likely limit commercial as well as residential development.

4.62
The secondary economic impact of the Lakefront Plant in Springfield would likely be similar to the impact which the 10,000-employee General Motors Lordstown Plant has had on Lordstown, Ohio. This facility is located in a small, rural community on the periphery of the Youngstown-Warren metropolitan area. The GM plant, like the proposed Lakefront Plant, is located on a major interstate highway. Lordstown is similar to Springfield with its lack of utility infrastructure and zoning ordinances designed to limit development. Secondary economic development related to the GM plant has occurred along the highways between Lordstown and existing major population centers and has not significantly affected the community's rural nature.

f) Pennsylvania Principal Study Area

4.63
The relative economic impact of the Lakefront Plant on the Pennsylvania Principal Study Area is expected to be substantially less than that projected for the Ohio Principal Study Area. The total employment impact by 1990 is estimated to be approximately 8,250 new jobs for the area, which represents six percent of the projected baseline. Approximately 6,350 of these jobs would be located on the plant site. Of the other 1,900 jobs, 1,200 are estimated to be located in the city of Erie, another 300 in Millcreek, and the remainder dispersed primarily among the other suburban Coastal Communities. The estimated secondary employment increases for the Coastal Communities of the Pennsylvania Principal Study Area are presented in Table 4-23. A sectoral breakdown of the total employment increase estimated to occur in the Pennsylvania Principal Study Area is shown on Table 4-24. The geographic distribution of the secondary employment impacts in this area would be similar to that of the Ohio Principal Study Area since the present economic centers are expected to receive the majority of the secondary employment increases. It is estimated that approximately 90 percent of the commercial activity generated in the area would likely accrue to the Millcreek and Erie central business districts and mall areas. The commercial activity generated in the other communities of the area is likely to be similar to that in the Ohio suburban communities. One can expect small convenience stores to expand or locate near areas of new housing developments. Increased noncommercial activity in the suburban

Table 4-23

New Secondary Employment in the Pennsylvania Principal Study Area -- 1979-1990

	1979		1981		1986		1990	
	Commercial(1)	Total	Commercial	Total	Commercial	Total	Commercial	Total
Total	105	255	780	1545	1200	2350	1175	2380
Springfield	10	10	50	110	75	465	75	620
Girard	*	40	25	125	30	75	30	60
Fairview	*	40	15	115	20	60	20	50
Millcreek	20	40	140	195	225	275	225	300
Other(2)	75	125	550	1000	850	1475	825	1350

(1) Includes wholesale/retail trade, F.I.R.E., and selected services.

(2) Other areas include the City of Erie.

*Negligible

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-24

Employment Impacts Compared to Baseline Projections in the Pennsylvania Principal Study Area -- 1979-1990

	1979 Impact	1979 Baseline	1979 % Impact	1981 Impact	1981 Baseline	1981 % Impact	1986 Impact	1986 Baseline	1986 % Impact	1990 Impact	1990 Baseline	1990 % Impact
Total Employment	1150	118,475	1%	8135	123,175	7%	9850	129,875	8%	8250	136,000	6%
Manufacturing	*	46,150	*	1470	48,700	3	4765	50,425	9	6260	52,600	12
Primary Metals	*	3,000	*	1170	3,050	38	4350	2,975	146	5875	2,925	200
Other	*	43,150	*	300	44,650	1	415	47,450	1	385	49,675	1
Non-Manufacturing	1150	72,325	2	6665	74,475	9	5085	79,450	6	1990	83,400	2
Wholesale/Retail Trade	75	22,850	*	450	23,650	2	825	25,150	3	825	26,350	3
Selected Services(1)	30	25,050	*	330	25,825	1	485	27,550	2	475	28,925	2
Transportation, Communication and Utilities	20	5,950	*	125	6,125	2	225	6,550	3	240	6,875	3
Construction	1025	4,000	26	5700	4,175	137	3425	4,850	71	300	5,380	6
Government	*	12,675	*	60	12,950	*	100	13,750	1	125	14,400	1
Agriculture/Mining	*	1,800	*	*	1,750	*	25	1,600	*	25	1,470	2

*Negligible

(1) Includes F.I.R.E., Selected Services, Medical Services, and Private Education.

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Coastal Communities would essentially be comprised of housing construction and Government employment (primarily educational). No structural changes are anticipated in the economic bases of the suburban communities.

4.64
Although the Erie City area would not undergo any substantial changes, some additional employment would be generated. Given its large manufacturing base, some increased activity would likely be generated by the indirect purchases of the proposed Lakefront Plant. In addition, the area's stone, clay, and glass sector would likely be a limited supplier of relatively small amounts of gravel, concrete, and other building materials during the plant construction period. Approximately 300 additional jobs are estimated for 1981, the peak construction year for the proposed Lakefront plant.

Labor Force and Employment

a) Regional Study Area

4.65
The estimated increases in the resident labor force and identification of the source of the increases are presented in Table 4-25. The primary assumptions underlying these estimates are the following: the labor force participation rates for original resident females would increase by one percentage point over the baseline projections; the labor force participation rates for original resident males would increase by one to two percentage points over the projected baseline rates; the participation rates for in-migrants wives is assumed to be 15 percent for wives of construction workers and 20 percent for wives of operations workers; and the participation rates for the children entering the labor force are assumed to be 60 percent for those 18 and over; this is similar to the national participation rates for the 18-24 age group.

4.66
The data in Table 4-25 indicate that the resident labor force increases over time as operations activity proceeds. For example, in 1981 the resident labor force is estimated to increase by less than 3,000 over the baseline level (1.3 percent). However, by 1986, the resident labor force is estimated to increase substantially due to the in-migrant operations workers and expansion in the original resident labor force. In 1986, the increase in the area labor force is estimated at 9,500, increasing an additional 2,800 to approximately 12,300 by 1990, which represents 5.1 percent of the projected baseline. The relative mix of original residents and in-migrant plant workers is expected to shift over time. In 1981, in-migrant construction and operations workers are estimated to comprise

Table 4-25

Estimated Impact on Labor Force in the Regional Study Area -- 1979-1990

	1979	1981	1986	1990
Baseline Labor Force	214,900	219,800	232,000	240,100
Labor Force Additions	115	2,860	9,510	12,265
In-Migrants	115	2,025	4,610	5,775
Construction	115	1,150	515	-
Wives	15	150	65	-
Operations	-	875	4,095	5,775
Wives	-	140	655	900
Children	-	-	180	440
Original Residents	-	835	4,900	6,490
Percent Impact on Labor Force	*	1.3%	4.1%	5.1%

*Negligible

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

approximately 60 percent of the 3,000 increase in the labor force. However, by 1986 these workers should comprise about 40 percent of the total labor force increase, even though in absolute terms their numbers rise substantially between 1981 and 1986. Their relative share of the total by 1990 is further diminished notwithstanding additional increases in absolute terms during this period. The increase in the labor force attributed to original residents increases from approximately 30 percent in 1981 to over 50 percent by 1990. Overall the rise in the original resident labor force is assumed to occur primarily in 1982 and 1987 in conjunction with the full implementation of Step I and II operations activity. Construction of the plant is not expected to substantially affect the area's labor force participation rates because of the specialized skill requirements for construction labor. It is assumed most workers of this nature are already in the labor force in one capacity or another. The increase in in-migrant workers results in an attendant rise in the number of spouses entering the area labor force. By 1990, approximately 900 are estimated to enter the labor force. Over time, children of the in-migrant workers can be expected to enter the labor force in increasing numbers. In 1986, they are expected to increase the labor force by less than 200, but by 1990 their contribution could be almost 450. The latter figure represents approximately eight percent of the total estimated in-migrant labor force.

4.67
As stated earlier, labor force and employment impacts during construction are considered to be temporary. For example, it has been estimated that about 1,000 construction workers and their families would migrate into the area in 1981. In 1986, construction activity would be substantially less than in 1981, consequently there is expected to be a requirement for only about 450 in-migrant construction worker families. Further, because there is no direct plant construction activity in 1990, there are no in-migrant construction workers adding to the labor force. In actuality, some of the in-migrant construction workers would probably stay in the area and either obtain jobs in the area or commute outside the area for employment. Therefore, to some extent the increase in the labor force presented in Table 4-25 is understated. If all the 1,000 in-migrant construction workers in the area in 1981 did not leave, then the labor force increase in 1990 is underestimated by approximately 10 percent or 1,250 (the additional 250 is accounted for by spouses and children). This would imply a labor force impact of 5.6 percent rather than 5.1 percent relative to the baseline labor force.

4.68
The impact on the unemployment rate and level in the Regional Study Area is presented in Table 4-26. The exclusion of the in-migrant construction workers from the labor force estimates should not

Table 4-26

Estimated Impact on Resident Employment, Labor Force, and Unemployment in the Regional Study Area -- 1979-1990

(Thousands)

	1979	1981	1986	1990
Resident Employment	200.2	212.1	230.5	240.8
Baseline	198.8	204.7	217.4	227.4
Impact	1.4	7.4	13.1	13.4
Resident Labor Force	215.0	222.7	241.2	252.4
Baseline	214.9	219.8	231.7	240.1
Impact	0.1	2.9	9.5	12.3
Unemployment Level				
Baseline	16.1	15.1	14.3	12.7
With Impact	14.8	10.6	11.1	11.6
Unemployment Rate				
Baseline	7.5%	6.9%	6.4%	5.3%
With Impact	6.9%	4.8%	4.6%	4.6%

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

substantially alter unemployment estimates since these workers, by necessity, are mobile and the construction work they would probably obtain outside the area has not been factored into the resident employment estimates. The unemployment estimates in this table should be viewed as a reasonable approximation of the impact on the Regional Study Area. Estimated rates of unemployment are, of course, sensitive to assumptions concerning both the number of in-migrants and the increase in the original resident labor force. For example, if no increase in the original resident labor force was assumed, the attendant unemployment rates for 1986 and 1990 would be 2.6 percent and 2.1 percent, respectively. Similarly, if an influx of in-migrant operations workers (other than those transferred) was not assumed, then unemployment rates for 1986 and 1990 would be estimated at 3.8 percent and 3.3 percent, respectively. In both cases, the implied unemployment rates would likely be significantly below the nationally projected rates.

4.69
The assumptions concerning in-migrants and original resident labor force increases implied in Tables 4-25 and 4-26 and the subsequent implied effects on the area unemployment rate are believed to reasonably reflect the likely occurrence of events. The Regional Study Area unemployment rate is not expected to fall dramatically below the national level given its historical record. This condition in itself would likely attract additional in-migrants, especially from the large surrounding urban areas where the unemployment rates have tended to run above the national rate and the unemployment pools are large. Additionally, it is the expressed intention of the applicant to hire area residents; therefore, an increase in the area's labor force participation rate appears likely. Although "new" labor force participants may not work at the proposed Lakefront Plant, many would likely be able to find employment because of the increased economic opportunities generated by the plant and related development activity. The rate of unemployment under plant-related impact conditions is estimated to be slightly less than five percent throughout the 1980's; however, the relative effect compared to the baseline diminishes over time (refer to Table 4-26). For example, in 1981, the level and rate of unemployment are estimated to be 4,500 and two percentage points below the projected baseline. However, by 1990 the impact is estimated to be only 1,100 and 0.7 percentage points below the baseline. The effects on the rate and level of area unemployment are expected to be relatively more significant in the early years given the assumptions regarding increases in the labor force.

4.70
Between 1981 and 1990, the resident labor force and related employment are estimated to increase by 9,400 and 6,000 respectively. The greater increase in the resident labor force reflects the higher

participation rates among original residents as well as the in-migrant operations workers coming into the area. Prior to 1982, the increase in the original resident labor force is assumed to be small because of the high levels of area unemployment. The secondary activities generated during this period would likely be filled by the unemployed. Direct plant employment during this period would be filled mostly by U.S. Steel transfers and skilled construction workers (the latter are assumed to already be in the labor force under the baseline scenario). With the decline in the level of unemployment in 1981 and the full implementation of Step I operations in 1982, the original resident labor force is expected to increase. Further substantial increases in the original resident labor force are assumed to occur in 1987 with the full implementation of Step II. In addition to the increase in the original resident labor force, the number of in-migrants working at the plant would increase, further raising the number of in-migrant dependents entering the labor force. The effect of the greater gains in the labor force relative to employment is that overall (i.e., with baseline added) the level of unemployment increases by approximately 1,000 between 1981 and 1990; however, the rate of unemployment is not expected to increase since both employment and labor force increase substantially between 1981 and 1990.

4.71
These unemployment projections do not include possible employment opportunities for construction workers outside the Regional Study Area. The applicant estimates that by 1981, about 1,800 original resident skilled construction workers will be employed at the Lakefront Plant. If these workers were able to find jobs at other projects outside the Regional Study Area or if some construction workers moved out of the Regional Study Area to take other jobs, the unemployment level by 1990 could be as low as 9,800, decreasing the unemployment rate to 3.9 percent. Although cyclical unemployment is common in the construction industry, it is likely that at least some of the workers who had worked at the site would find other construction jobs in the years following plant completion. Estimates of unemployment in the Regional Study Area presented in Table 4-25 therefore represent a "worst-case" situation.

4.72
The data presented in Table 4-25 implicitly assume that all the in-migrants would establish permanent residence in the area immediately upon securing employment. This, of course, is an oversimplification. It can be expected that in the short term, some in-migrant plant workers could commute to work on a daily or weekly basis from outside the study area prior to establishing residence. Several factors could cause workers who would eventually move to the Regional Study Area to commute on a daily or weekly basis. Direct and secondary

workers who are transferred to the Regional Study Area or find employment there may not choose to move their families until the end of the school year. There could also be a period of several months between the time a worker actually needs to be at his new job and the time he can sell a previous home and find a new one in the Regional Study Area. These and similar considerations could cause some workers to be weeklies or commuters (depending on the distance between their previous homes and the study area) for anywhere from a few months to a year.

4.73
The economic effect of some operations-related workers being weeklies or commuters on a short-term basis would be a somewhat smaller level of induced activity during a period. Until these workers become permanent residents of the Regional Study Area, most of their spending would occur in the areas of their previous residence, comparable to construction weeklies and commuters. Thus, the induced employment and payrolls projected for 1981 and 1986 may slightly overstate the actual levels. It is possible that a few operations-related employees would not become residents of the Principal Study Area. Some direct and secondary workers who live outside the Principal Study Area (either in other parts of the Regional Study Area or outside the three-county region in cities such as Cleveland) may choose to commute to jobs at the plant or in related facilities. However, it is expected that the number of such workers would likely be quite small and any reduction in the level of induced activity associated with them would be negligible.

b) Original Resident Employment

4.74
The jobs which could be filled by spouses and children of in-migrants are not limited to those secondary jobs created by development of the Lakefront Plant. As mentioned previously, it is likely that some residents employed in the Regional Study Area would leave their jobs in order to take higher-paying positions at the plant or in related activities. The positions which these workers vacate could be filled either by other original residents or by in-migrant workers. Since the extent of this job-switching cannot be estimated, it has been assumed for the purpose of this discussion that all in-migrants employed in the Regional Study Area would hold jobs created by the development of the Lakefront Plant. Original resident direct employment would be the difference between total resident direct employment and the number of primary in-migrants (both transfers and others) expected to be employed of the plant under the intermediate in-migrant alternative. However, since many of the direct operations jobs would be filled by U.S. Steel transfers (1,690 or 20 percent by 1990), the original resident share of employment would be the percent

of jobs available for residents held by these workers. By 1990, original residents are expected to hold 4,175 operations jobs at the Lakefront Plant, some 62 percent of the jobs available.

4.75
The estimates of the original resident share of secondary employment are based on assumptions about the number of additional in-migrants (spouses and children of in-migrant plant workers) who would seek work in the Regional Study Area. Three alternative estimates of secondary in-migrant employment have been developed:

- Case 1. All of the spouses and children of the primary in-migrants who enter the labor force are employed in secondary jobs. This would represent the minimum original resident employment alternative;

- Case 2. Spouses and children experience the same unemployment rate as the total area labor force. This would represent the intermediate level of original resident employment.

- Case 3. No in-migrant spouses and children find jobs in the study area. This would represent the maximum original resident employment level.

Although Case 2 is considered to represent an intermediate level of original resident employment, it is possible that this alternative may somewhat understate conditions. It is likely that long-term area residents would have an advantage over in-migrants when seeking employment in local businesses. However, the skills of both original resident and in-migrant workers to the labor force would affect the ability of these people to find work. Therefore, the application of the area unemployment rate to the additional in-migrants seems a reasonable approach to estimating in-migrant unemployment. Furthermore, the difference between Case 1 and Case 2 would be only 60 jobs by 1990, so that even if the in-migrant spouses and children experienced a lower unemployment rate, the effect on original resident employment would not be significant.

4.76
The applicant estimates that by 1990 original residents would hold 7,660 of the new jobs, or 66 percent of the jobs available (refer to Table 4-27). Although this is nearly 900 fewer jobs than held by this group in 1986, the decrease would be the result of the loss of construction jobs in the years following 1987. Even so, the decrease in original resident employment would be only about half the number of direct original resident construction employment expected in 1986. Operations-related original resident employment would increase

Table 4-27

Estimates of Original Resident Employment in the Regional Study Area -- 1979-1990

		1981			1986			
	1979	Construction	Operations	Total	Construction	Operations	Total	1990
Resident Employment	1,430	4,875	2,475	7,350	3,395	9,750	13,095	13,375
Direct	905	2,885	1,710	4,595	2,130	6,330	8,460	8,450
Transfers	-	-	540	540	-	1,690	1,690	1,690
Jobs Available	905	2,885	1,170	4,055	2,130	4,640	6,770	6,760
In-migrants	100	1,000	170	1,170	450	1,470	1,920	2,585
Original Residents	805	1,885	1,000	2,885	1,680	3,170	4,850	4,175
Secondary	525	1,990	765	2,755	1,215	3,420	4,635	4,925
Transfers	-	-	25	25	-	100	100	160
Jobs Available	525	1,990	740	2,730	1,215	3,320	4,535	4,765
In-migrants (Spouses and Children)	15	150	140	290	65	835	900	1,340
Original Residents								
Case 1	510	1,840	600	2,440	1,150	2,485	3,635	3,425
Case 2	510	1,850	605	2,455	1,155	2,525	3,680	3,485
Case 3	525	1,990	740	2,730	1,215	3,320	4,535	4,765
Total Employment								
Jobs Available	1,430	4,875	1,910	6,785	3,345	7,960	11,305	11,525
In-migrants								
Case 1	115	1,150	310	1,460	515	2,305	2,820	3,925
Case 2	115	1,140	305	1,445	510	2,265	2,775	3,865
Case 3	100	1,000	170	1,170	450	1,470	1,920	2,585
Original Residents								
Case 1	1,315	3,725	1,600	5,325	2,830	5,655	8,485	7,600
Case 2	1,315	3,735	1,605	5,340	2,835	5,695	8,530	7,660
Case 3	1,330	3,875	1,740	5,615	2,895	6,490	9,385	8,940
Original Resident Percent of Available Jobs								
Direct	89	65	85	71	79	68	72	62
Secondary								
Case 1	97	92	81	89	95	75	80	72
Case 2	97	93	82	90	95	76	81	73
Case 3	100	100	100	100	100	100	100	100
Total								
Case 1	92	76	84	78	85	71	75	66
Case 2	92	77	84	79	85	72	75	66
Case 3	93	79	91	83	87	82	83	78

Source: Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; Arthur D. Little, Inc. estimates.

from about 5,700 in 1986 to 7,660 in 1990. The implication of this increase in operations-related employment is a greater number of jobs for those unemployed or new entrants to the labor force. It is likely that construction workers who had worked at the Lakefront Plant would seek similar work outside the area after 1987. If this occurs, the 2,000 additional operations-related jobs available for original residents between 1986 and 1990 would be filled by those who would otherwise have been unemployed. Even if the new jobs were filled by those previously employed, this would open up baseline positions for the unemployed. As noted previously, higher participation rates would add about 1,500 original residents to the labor force between 1986 and 1990. Therefore, during the same period some 500 jobs would become available for persons who would have been unemployed under baseline conditions.

Payrolls

a) Regional Study Area

4.77
Total plant-related payrolls (in 1975 dollars) generated in the Regional Study Area are expected to amount to some $33 million in 1979, $218 million in 1981, $248 million in 1986, and $185 million in 1990 (refer to Table 4-28). Almost 75 percent of total payrolls are expected to be generated by direct activity, another 18 percent by induced activity, and the remainder by indirect activity. The decrease in total plant-related payrolls between 1986 and 1990 is related to the completion of plant construction in 1987. Construction-related payrolls are expected to reach a maximum of $190 million in 1981, the year of peak construction activity. After 1987, all payroll impacts would be related to the operation of the facility.

4.78
Estimates of total direct payroll were derived based upon average annual earnings for each occupation. As shown in Table 4-29, total annual payroll generated at the facility is expected to exceed $86 million during Step I and $135 million during Step II. The salary estimates given in Table 4-29 represent base pay, inclusive of incentive, shift and Sunday premiums, overtime, vacation, cost of living adjustments, and holiday pay. In addition, steel worker fringe benefits, which have been excluded from the data on Table 4-29, are estimated at about 25 percent of annual salaries. Most of these fringe benefits are accounted for by contributions to worker retirement funds, pension funds, and related items. Most of the monies associated with these fringe benefits will not be turned into additional spending in the study area but represent deferred payments. However, approximately 25 percent of the fringe benefits (seven percent of

Table 4-28

Payrolls Generated in the Regional Study Area -- 1979-1990
(Millions of 1975 Dollars)

	1979	1981	1986	1990
Direct				
Construction-Related	$27.0	$ 164.3	$102.4	$ 0
Operations-Related	0	25.2	98.9	135.8
Total Direct	$27.0	$189.5	$201.3	$135.8
Indirect				
Construction-Related	$0.4	$4.5	$3.0	$0
Operations-Related	0	0	9.8	16.0
Total Indirect	$0.4	$4.5	$12.8	$16.0
Induced				
Construction-Related	$5.2	$15.9	$ 8.8	$ 0
Operations-Related	0	7.8	24.8	32.8
Total Induced	$5.2	$23.7	$33.6	$32.8
Total Impact	$32.6	$217.7	$247.7	$184.6
Baseline	$1,980.8	$2,046.3	$2,166.1	$2,261.9
Total Impact as a Percent of Baseline	2%	11%	11%	8%

Source: Regional Economic Structure baseline, Construction Labor Requirements and Characteristics and Economincs and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-20

Payroll at the Lakefront Facility During Operations

Occupation/Skill Category	Average Annual Wage/Salary	Million 1975 $ ---Training---- Step I	Step II	--Operations--- Step I	Step II
Officers & Managers	$22,400	$ 6.7	$ 1.6	$11.0	$ 15.1
Professionals	19,900	1.3	0.5	1.5	2.2
Technicians	15,400	0.9	0.4	2.8	4.1
Office & Clerical Workers	12,400	1.2	0.5	7.4	10.8
Skilled Workers	16,900	13.3	7.5	35.7	56.4
Semiskilled Workers	15,100	1.4	1.2	20.9	34.9
Unskilled Workers	14,100	0.1	0.5	6.0	10.5
Service Workers	12,600	0.3	-	1.4	1.8
Total		$25.2	$12.2	$86.7	$135.8

Source: United States Steel Corporation.

salary) or an average of $1,200 per worker, represents insurance benefits (health, hospital, medical, and dental). It is likely that a large share of these benefits will be turned into spending in the Regional Study area, accruing to local hospitals, doctors, dentists, etc. The insurance-related benefits would add an additional $6-10 million to total labor costs at the facility at Step II, while further increasing the potential new income to be brought into the Regional Study Area as a result of the facility's operation.

4.79
Secondary payroll impacts are expected to follow the same general pattern as direct payrolls. Indirect payrolls related to construction would amount to only about three percent of direct construction payrolls since the bulk of construction materials and equipment is expected to be purchased outside the Regional Study Area. There would be no operations-related indirect payrolls in 1981. Although workers at the Lakefront Plant are expected to be hired in 1981, there would be little operations-related indirect payroll since actual steelmaking operations would not begin until 1982. Thus, there would be no significant operational purchases from suppliers in the Regional Study Area in 1981. Operations-related indirect payrolls would represent about 10 percent of direct operations payrolls in 1986 and 12 percent in 1990. This increase is based on the expectation that some supplier industries would expand or be established in the latter part of the projection period.

4.80
Construction-related induced payroll would be some 20 percent of direct construction payroll in 1979 and would decrease to approximately 10 percent in 1981 and 1986. This reflects the assumption that in these two years, which represent peak construction employment for Steps I and II, respectively, a greater percentage of the construction work force is expected to be made up of weeklies and commuters, who are likely to spend relatively little money in the study area compared to residents (original residents and movers). Thus in these two years, a smaller share of direct construction payroll would be spent in the area economy. Operations induced payroll is expected to be about 25 percent of direct operations payroll. This is significantly higher than the share for construction-induced payrolls since all operations workers are expected to live (and spend the majority of their income) in the Regional Study Area.

4.81
The estimated distribution of payrolls among Regional Study Area residents (original residents and in-migrants), weeklies, and commuters is shown in Table 4-30. Area residents would receive 68 percent of total payrolls in 1979, only 50 percent in 1981 when the

Table 4-30

Distribution of Payroll by Residence Status in the Regional Study Area -- 1979-1990
(Millions of 1975 Dollars)

	1979		1981		1986		1990	
	Payroll	Percent	Payroll	Percent	Payroll	Percent	Payroll	Percent
Total Direct	$27.0	100%	$189.5	100%	$201.3	100%	$135.8	100%
Residents[1]	16.7	62	80.4	42	139.8	70	135.8	100
Weeklies	0.2	1	35.2	19	20.4	10	0	
Commuters	10.1	37	73.9	39	41.1	20	0	-
Total Secondary[2]	$ 5.6		$ 28.2		$ 46.4		$ 48.8	
Total Payroll	$32.6	100%	$217.7	100%	$247.7	100%	$184.6	100%
Residents[1]	22.3	68	108.6	50	186.2	75	184.6	100
Weeklies	0.2	1	35.2	16	20.4	8	0	-
Commuters	10.1	31	73.9	34	41.1	17	0	-

(1) Includes original residents and movers.

(2) All secondary workers are assumed to be residents of the Regional Study Area.

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

greatest number of construction weeklies and commuters would be required, and 75 percent in 1986. After construction is completed in 1987, all plant-related payrolls are expected to be earned by area residents. Resident payrolls would reach a maximum of $186 million in 1986, essentially the same as the payroll increase generated by plant operations and related activities in 1988 and the following years. The average annual wages per worker associated with the Lakefront Plant and related development are a function of the industry mix of the new employment. Since the majority of new jobs would be in relatively high-paying positions associated with construction and operation of the facility, the plant-related average wage per worker would be significantly higher than that expected under baseline conditions. Similarly, the average wage for secondary workers in nonmanufacturing activities would be higher than the comparable baseline average wage because of the large number of jobs created in higher-paying sectors (construction, transportation, etc.).

4.82
Although the average plant-related wage would be substantially higher than that under baseline conditions, it is not expected that this would result in significant wage pressures throughout the area. The high wages would primarily accrue to the steel plant workers and they are estimated to comprise only 3.5 percent of the area employment force. Even under the baseline projections, the workers in the primary metals sector are expected to receive wages well above the overall average for manufacturing. Some employers may be required to pay higher wages to retain certain experienced workers who would otherwise seek employment at the Lakefront Plant. In general, however, the jobs which these residents leave should be able to be filled by current members of or new entrants to the labor force at existing wage rates. (In fact, such new workers would likely be employed at wages below those paid to more experienced employees.) While the overall unemployment rate in the Regional Study Area would be decreased as a result of plant development, increases in the size of the labor force should still provide a large pool of people seeking work (estimated at more than 10,000). Any real increase in wages in the Regional Study Area would be more likely to result from events not related to plant development (i.e. national or regional union contract changes, increase in productivity). In the Pennsylvania Regional Study Area, the share of total employment represented by the three highest paying sectors (primary metals, other durables, and construction) increased from 19 percent to 21 percent over the 1965-1975 period. However, the change in real wages was less than one percent during the same period. This would tend to support the conclusion that a relatively high average wage for steel workers should not increase average wages in other sectors significantly.

4.83
The estimated average annual wages earned by plant-related workers in manufacturing and nonmanufacturing activities is shown in Table 4-31. Highest wages would be earned by direct workers, with the construction-related average somewhat higher than the operations-related average. The lower operations wage levels in 1981 and 1986 reflect the lower average wages paid to employees undergoing training in these years. After training has been completed, direct manufacturing workers are expected to earn an average of about $16,050 (in 1975 dollars) annually. More than 85 percent of secondary payrolls are expected to be generated in nonmanufacturing activities. Secondary nonmanufacturing wages will probably be higher than the average under baseline conditions because of the large number of plant-related workers in the higher-paid sectors, particularly construction. For example, in 1990, 13 percent of plant-related nonmanufacturing employment would be in the construction sector, while the comparable figure under baseline conditions would be eight percent. However, the overall average for plant-related nonmanufacturing wage would likely decrease over the course of the projection period as infrastructure construction is completed and higher overall resident payrolls create additional induced impacts in the relatively lower-paying trade and services sectors.

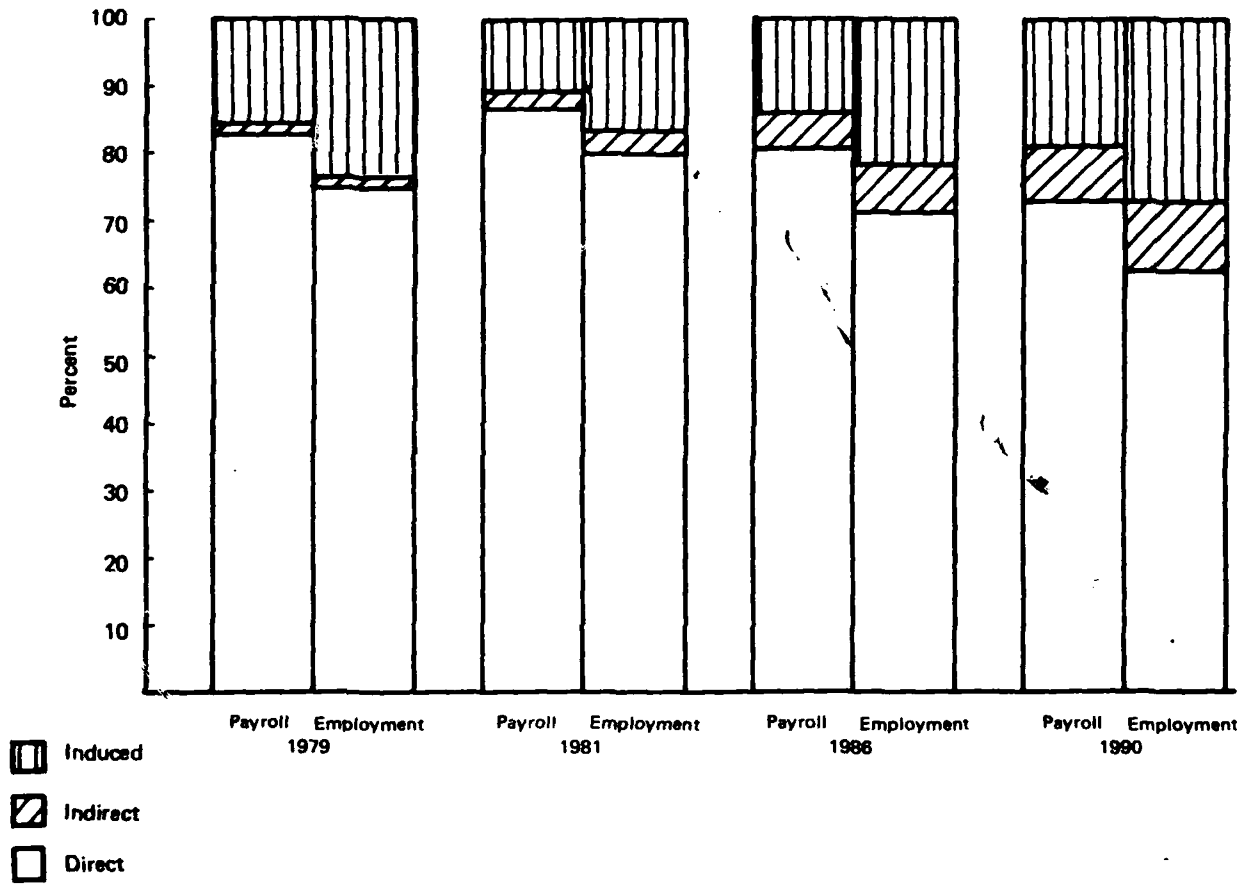
4.84
The long-term (post-construction period) average salary associated with plant-related workers would be $13,775-$15,050 for manufacturing workers, and $9,550 for nonmanufacturing workers. While plant-related wage averages would be substantially higher than baseline wage averages (30 percent in manufacturing and 12 percent in nonmanufacturing) these higher wages would be earned by a fairly small share of the total work force. Moreover, the highest average earnings would accrue to the direct employees. As noted, even under baseline conditions, primary metals industry workers would be expected to earn a significantly higher-than-average wage. The difference between payroll and employment impacts is illustrated in Figure 4-7. Due to the relatively high wages paid to direct construction and operations workers, the percent of total payrolls generated by direct activity is larger than the share of employment generated by direct activity. On the other hand, payrolls generated in secondary activities represent a smaller share of total payroll than the secondary employment share of total. This differential is expected to become wider over the course of the projection period as induced employment shifts away from relatively higher-paying activities toward more jobs in the relatively lower-paying trade and service sectors. By 1990, direct activity would account for some 73 percent of total payrolls, but only 63 percent of employment. Employees in induced activities are estimated to hold 26 percent of total plant-related jobs but receive only 18 percent of total

Table 4-31

[illegible]lls and Average Earnings Per Worker in the Regional Study Area -- 1979-1990
(1975 Dollars)

	1979		1981		1986		1990	
	Total Payroll (Millions)	Average Wages per Worker	Total Payroll (Millions)	Average Wages per Worker	Total Payroll (Millions)	Average Wages per Worker	Total Payroll (Millions)	Average Wages per Worker
[illegible] Payrolls	$ 27.0	$17,525	$ 189.5	$17,100	$ 201.3	$16,575	$ 135.8	$16,050
[illegible]facturing (Operations)	-	-	25.2	14,825	98.9	15,650	135.8	16,050
Non-Manufacturing (Construction)	27.0	17,525	164.3	17,500	102.4	17,575	-	-
[illegible] Secretary Payrolls	$ 5.6	$10,575	$ 28.2	$ 9,975	$ 46.4	$ 9,850	$ 48.8	$ 9,850
Manufacturing	0.3	12,675	4.2	12,750	6.3	12,600	6.0	12,[illegible]
Non-Manufacturing	5.3	10,450	24.0	9,600	40.1	9,525	42.8	9,550
Total Impact	$ 32.6	$15,750	$ 217.7	$15,650	$ 247.7	$14,700	$ 184.6	$13,775
Manufacturing	0.3	12,675	29.4	14,475	105.2	15,425	141.8	15,850
Non-Manufacturing	32.3	15,800	188.3	15,850	142.5	14,200	42.8	9,550
Baseline	$1,980.8	$ 9,850	$2,046.4	$ 9,850	$2,166.1	$ 9,850	$2,261.9	$ 9,825
Manufacturing	913.0	12,200	943.8	12,200	988.5	12,200	1,024.2	12,200
Non-Manufacturing	1,067.8	8,425	1,102.5	8,450	1,177.6	8,500	1,237.7	8,525

Source: **Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.**



Source: Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

FIGURE 4–7 PERCENT OF TOTAL PAYROLL AND EMPLOYMENT DUE TO DIRECT, INDIRECT, AND INDUCED ACTIVITY IN THE REGIONAL STUDY AREA

payroll. Indirect activity would account for the remaining nine percent of payrolls and 11 percent of employment.

b) Ohio Local Study Area

4.85
Payrolls (in 1975 dollars) generated by the proposed facility in the Ohio Local Study Area are expected to be $10 million in 1979, $82 million in 1981, $92 million in 1986, and $58 million in 1990, an increase of some 86 percent over projected baseline payrolls in 1990 (refer to Table 4-32). The largest component of these increases would be the direct payroll resulting from construction and operation of the plant. Secondary payrolls are estimated at almost $17 million in 1990, or 28 percent of total plant-related payrolls. Plant-related secondary payrolls generated in manufacturing industries in Conneaut would be negligible until the slag processing operation begins along with actual steelmaking operations in 1982. Manufacturing activity is expected to make only a small contribution to total secondary payrolls over the analysis period (refer to Table 4-33). The majority of secondary payrolls would be generated in wholesale/retail trade, services, transportation, Government (primarily education), and construction (both infrastructure construction and maintenance construction at the Lakefront Plant itself).

c) Ohio Principal Study Area

4.86
Total payrolls (in 1975 dollars) generated by the proposed facility in the Ohio Principal Study Area are expected to amount to $12 million in 1979, $89 million in 1981, $100 million in 1986, and to stabilize at $67 million after construction of the plant is completed in 1987 (refer to Table 4-34). The 1990 impact is expected to amount to an increase of 19 percent over baseline payrolls, compared to a 1990 employment impact of 14 percent. By 1990, direct activities are expected to account for 63 percent of total payrolls, with secondary activities contributing the remaining 37 percent. Nearly 90 percent of the payrolls generated in the Ohio Principal Study Area are expected to be the result of the direct, indirect, and induced activity in Conneaut. Most of the remainder would be generated in Ashtabula City's manufacturing and commercial establishments, although other segments of the area would experience some payroll increases in population serving sectors. Secondary payrolls generated in the Ohio Principal Study Area are shown in Table 4-35. Without the substantial direct payrolls, secondary development would represent an estimated increase of seven percent over baseline payroll levels in 1990. The greatest secondary payrolls would be created in the wholesale/retail trade sector, followed by services and construction. Transportation payrolls (principally in Conneaut) are estimated to amount

Table 4-32

Payroll Generated in the Ohio Local Study Area -- 1979-1990
(Millions of 1975 Dollars)

	1979	1981	1986	1990
Direct				
Construction-Related	$ 9.2	$ 69.0	$ 47.1	$ 0
Operations-Related	0	7.9	31.0	41.7
Total Direct	$ 9.2	$ 76.9	$ 78.1	$ 41.7
Indirect				
Construction-Related	-	$ 0.2	$ 0.1	$ 0
Operations - Related	0	0	4.4	6.9
Total Indirect	-	$ 0.2	$ 4.5	$ 6.9
Induced				
Construction-Related	$ 0.9	$ 3.4	$ 2.1	$ 0
Operations-Related	0	1.8	7.0	9.7
Total Induced	$ 0.9	$ 5.2	$ 9.1	$ 9.7
Total Impact	$10.1	$ 82.3	$ 91.7	$ 58.3
Baseline	$58.9	$ 60.8	$ 64.5	$ 67.4
Total Impact as a Percent of Baseline	17%	135%	142%	86%

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-33

Secondary Payrolls Generated in the Ohio Local Study Area -- 1979-1990
(Millions of 1975 Dollars)

	1979			1981			1986			1990		
	Total Impact	Baseline	Percent Impact	Total Impact	Baseline	Percent Impact	Total Impact	Baseline	Percent Impact	Total Impact	Baseline	Percent Impact
Total Payroll	$ 0.9	$ 58.9	2%	$ 5.4	$ 60.8	9%	$ 13.6	$ 64.5	21%	$ 16.6	$ 67.4	25%
Manufacturing	-	28.2	-	-	29.1	-	0.1	30.3	-	0.1	31.2	-
Fabricated Metals/Machinery	-	14.2	-	-	14.6	-	0.1	15.3	1	0.1	15.9	1
Chemicals/Rubber	-	6.6	-	-	6.8	-	-	7.0	-	-	7.2	-
Other	-	7.4	-	-	7.7	-	-	8.0	-	-	8.1	-
Non-Manufacturing	0.9	30.7	3	5.4	31.7	17	13.5	34.2	39	16.5	36.2	46
Commercial (1)	0.5	8.4	6	3.3	8.8	37	5.8	9.7	60	6.1	10.5	58
Other (2)	0.1	11.6	1	0.9	12.2	7	2.6	13.4	19	4.1	14.4	28
Transportation Services	-	7.8	-	0.1	7.8	1	1.5	8.1	19	2.5	8.3	30
Construction	0.3	2.9	10	1.1	2.9	38	3.6	3.0	120	3.8	3.0	127

(1) Commercial includes wholesale/retail trade, F.I.R.E., and selected services.

(2) Other includes utilities, communications, private education, medical services, and government.

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-34

Payrolls Generated in the Ohio Principal Study Area -- 1979-1990
(Millions of 1975 Dollars)

	1979	1981	1986	1990
Direct				
Construction-Related	$ 9.2	$ 69.0	$ 47.1	$ 0
Operations-Related	0	7.9	31.0	41.7
Total Direct	$ 9.2	$ 76.9	$ 78.1	$ 41.7
Indirect				
Construction-Related	-	$ 0.3	$ 0.2	$ 0
Operations-Related	-	0	4.8	7.8
Total Indirect	-	$ 0.3	$ 5.0	$ 7.8
Induced				
Construction-Related	$ 2.4	$ 7.6	$ 4.2	$ 0
Operations-Related	0	4.2	13.0	17.1
Total Induced	$ 2.4	$ 11.8	$ 17.2	$ 17.1
Total Impact	$11.6	$ 89.0	$100.3	$ 66.6
Baseline	$301.5	$313.5	$333.1	$348.8
Total Impact as a Percent of Baseline	4%	28%	30%	19%

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

to nearly $3 million after Step II operations begin. Even with significantly higher wages in its various industries, manufacturing is expected to account for only four percent of secondary payrolls.

d) Pennsylvania Local Study Area

4.87
Payrolls (in 1975 dollars) generated by the proposed facility in the Pennsylvania Local Study Area are estimated at $18 million in 1979, $114 million in 1981, $129 million in 1986, and $103 million in 1990, more than half of all payrolls generated in the Regional Study Area (refer to Table 4-36). However, since there is no established manufacturing or large-scale commercial base in this community, some 98 percent of these payroll levels are projected to be the result of direct and indirect (maintenance construction and slag processing) activity at the plant site. Plant-related development is expected to create some $2 million in induced payrolls by 1990. About half of this amount would be spent in the area's limited retail and services establishments. The remainder would be generated in Government and other population-related sectors, with the greatest share going to education payrolls. Even though there would be substantial plant-related population growth and associated earnings in Springfield, it is not likely that there would be significant growth in commercial activities, given the proximity of such sectors in Conneaut, Millcreek, and Erie City.

e) Pennsylvania Principal Study Area

4.88
Payrolls (in 1975 dollars) generated by the proposed facility in the Pennsylvania Principal Study Area are expected to amount to $21 million in 1979, $129 million in 1981, $147 million in 1986, and $118 million in 1990 which represents an impact of nine percent above baseline payroll levels (see Table 4-37). While total payrolls generated in the Pennsylvania Principal Study Area are expected to be considerably larger than those in the Ohio Principal Study Area, the impact in percentage terms would be smaller because of the larger economic base of the Pennsylvania portion of the Regional Study Area. Payrolls generated in Springfield, principally the direct operations of the plant, are estimated to account for about 87 percent of all plant-related payrolls in the Pennsylvania Principal Study Area. However, manufacturing activities in the Erie area and commercial activities in both Millcreek and Erie City are expected to account for a substantial share of the induced and indirect payrolls created by Lakefront Plant development.

4.89
The distribution of secondary payrolls is shown in Table 4-38. By 1990, the indirect and induced payroll impact is expected to be some

Table 4-35

Secondary Payrolls by Sector in the Ohio Principal Study Area -- 1979-1990
(Millions of 1975 Dollars)

	1979			1981			1986			1990		
	Total Impact	Baseline	Percent Impact	Total Impact	Baseline	Percent Impact	Total Impact	Baseline	Percent Impact	Total Impact	Baseline	Percent Impact
Total Payroll	$ 2.4	$ 301.5	1%	$ 12.1	$ 313.5	4%	$ 22.2	$ 333.1	7%	$ 24.9	$ 348.8	7%
Manufacturing	-	143.8	-	0.1	150.3	-	0.6	155.5	-	1.0	159.6	1
Non-Manufacturing	2.4	157.7	2	12.0	163.2	7	21.6	177.6	12	23.9	189.2	13
Wholesale/Retail Trade	0.6	35.7	2	3.9	36.8	11	7.0	39.6	18	7.4	41.9	18
Services(1)	0.2	36.0	1	2.7	38.1	7	4.5	43.5	10	4.7	47.8	10
Transportations, Communications and Utilities	0.1	40.0	1	1.1	40.6	3	3.6	42.2	9	5.0	43.5	11
Construction	1.3	13.9	9	3.5	14.4	24	4.7	15.7	30	4.0	16.8	24
Government	-	29.0	-	0.7	30.3	2	1.6	33.9	5	2.6	36.7	7
Agriculture/Mining	-	3.1	-	0.1	3.0	3	0.2	2.7	7	0.2	2.5	8

(1) Includes F.I.R.E., selected services, and medical services.

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-36

Payrolls Generated in the Pennsylvania Local Study Area -- 1979-1990
(Millions of 1975 Dollars)

	1979	1981	1986	1990
Direct				
Construction-Related	$17.8	$ 95.3	$ 55.3	$ 0
Operations-Related	0	17.3	67.9	94.1
Total Direct	$17.8	$112.6	$123.2	$ 94.1
Indirect				
Construction-Related	-	-	$ 0	$ 0
Operations-Related	-	-	4.0	6.5
Total Indirect	-	-	$ 4.0	$ 6.5
Induced				
Construction-Related	$ 0.1	$ 0.6	$ 0.2	$ 0
Operations-Related	0	0.5	2.0	1.9
Total Induced	$ 0.1	$ 1.1	$ 2.2	$ 1.9
Total Impact	$17.9	$113.7	$129.4	$102.5

Source: Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-37

Payrolls Generated in the Pennsylvania Principal Study Area -- 1979-1990
(Millions of 1975 Dollars)

	1979	1981	1986	1990
Direct				
Construction-Related	$ 17.8	$ 95.3	$ 55.3	$ 0
Operations-Related	0	17.3	67.9	94.1
Total Direct	$ 17.8	$ 112.6	$ 123.2	$ 94.1
Indirect				
Construction-Related	$ 0.4	$ 4.2	$ 2.8	$ 0
Operations-Related	0	0	5.0	8.2
Total Indirect	$ 0.4	$ 4.2	$ 7.8	$ 8.2
Induced				
Construction-Related	$ 2.8	$ 8.3	$ 4.6	$ 0
Operations-Related	0	3.6	11.8	15,7
Total Induced	$ 2.8	$ 11.9	$ 16.4	$ 15.7
Total Impact	$ 21.0	$ 128.7	$ 147.4	$ 118.0
Baseline	$1,179.7	$1,218.4	$1,296.8	$1,359.6
Total Impact as a Percent of Baseline	2%	11%	11%	9%

Source: Regional Economic Structure Baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-38

Secondary Payrolls by Sector in the Pennsylvania Principal Study Area -- 1979-1990
(Millions of 1975 Dollars)

	1979			1981			1986			1990		
	Total Impact	Baseline	Percent Impact	Total Impact	Baseline	Percent Impact	Total Impact	Baseline	Percent Impact	Total Impact	Baseline	Percent Impact
Total Payroll	$ 3.2	$1,179.7	-	$16.1	$1,218.4	1%	$ 24.2	$1,296.8	2%	$ 23.9	$1,359.6	2%
Manufacturing	0.3	575.1	-	4.1	594.6	1	5.7	628.0	1	5.0	654.7	1
Non-Manufacturing	2.9	604.6	-	12.0	623.8	2	18.5	668.8	3	18.9	704.9	3
Wholesale/Retail Trade	0.7	156.8	-	3.8	162.3	2	6.2	172.6	4	6.2	180.8	3
Services[(1)]	0.4	194.2	-	2.9	200.4	1	4.4	214.0	2	4.3	224.9	2
Transportation, Communi-cations and Utilities	0.3	71.3	-	1.5	73.3	2	2.7	78.2	3	3.1	82.2	4
Construction	1.5	57.9	3%	3.2	61.3	5	4.0	71.0	6	4.0	78.9	5
Government	-	113.9	-	0.5	116.4	-	1.0	123.7	1	1.1	129.5	1
Agriculture/Mining	-	10.5	-	0.1	10.1	1	0.2	9.3	2	0.2	8.6	2

(1) Includes F.I.R.E., selected services, and medical services.

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

$24 million with 79 percent in nonmanufacturing sectors. This is less than the secondary payroll impact expected in the Ohio Principal Study Area ($25 million), principally because of the difference between Conneaut and Springfield. Conneaut's existing commercial base is larger than Springfield's and would be more convenient to the population concentrated in the Local Study Area than commercial sectors in Millcreek and Erie, although additional annual payrolls of some $15 million are also expected to be created there.

Value of Shipments

4.90
The value of shipments has not been estimated for population-based induced sectors, i.e., infrastructure construction, medical services, Government, and miscellaneous utility operating labor. Employment and payrolls generated in these areas are essentially a function of in-migrant population rather than consumer spending and were estimated and assessed separately. The direct value of materials and services in 1975 dollars associated with construction of the Lakefront Plant has been estimated by U.S. Steel at $3.5 billion ($2.1 billion for Step I and $1.4 billion for Step II). The value of product shipments associated with plant operations has been estimated at $800 million for Step I and $1.7 billion for Step II (refer to Table 4-39). Shipment data for the facility in tonnage terms were converted to a value basis. Based upon data provided by U.S. Steel for three of its facilities (Youngstown, Gary, and Geneva) and that published by the American Iron and Steel Institute, estimates of average price per ton for trade sheets and plates and interworks sheets were derived for 1975. These estimates were then applied against expected product shipment levels during the proposed facility's 1982-1990 operations to derive a dollar value of shipment at the facility.

4.91
The projected value of shipments generated in the Regional Study Area due to secondary activity associated with the proposed Lakefront Plant is presented in Table 4-40. During 1990 the plant-related impact is expected to be more than $200 million, of which almost 75 percent would be generated through induced activities. This would represent an increase of two percent over projected baseline value of shipments for the Regional Study Area. The overall level of increase in the value of shipments is somewhat higher than that for secondary payrolls (2.4 percent in 1990 versus 2.2 percent for payrolls) because of the specific sectors in which these impacts are expected to occur. The majority of secondary impacts are expected to occur in the wholesale/retail trade sector, which has a relatively low payroll-to-sales ratio. In other words, a dollar of payroll generated in this sector has an associated value of shipments significantly higher than a dollar of payroll generated in the services or

Table 4-39

Shipments at the Proposed Lakefront Facility During Operations

Year	Customer Type	Products	Tonnage (MM Tons)	Value Per Ton (1975 $)		Value of Shipments (MM 1975$)
1982	Trade	Sheets	1.07	$260		278.2
	Interworks	Sheets	0.79	250		197.5
					TOTAL	$ 475.7
1983	Trade	Sheets	1.90	$260		494.0
	Interworks	Sheets	1.40	250		350.0
					TOTAL	$ 844.0
1984-1986	Trade	Sheets	1.90	$260		494.0
	Interworks	Sheets	1.40	250		350.0
					TOTAL	$ 844.0
1987	Trade	Plates	0.86	$330		283.8
	Trade	Sheets	2.52	260		655.2
	Interworks	Sheets	1.68	250		420.0
					TOTAL	$1359.0
1988-1990	Trade	Plates	1.52	$330		501.6
	Trade	Sheets	3.00	260		780.0
	Interworks	Sheets	1.90	250		475.0
					TOTAL	$1756.6

Source: United States Steel Corporation; Arthur D. Little, Inc. estimates.

Table 4-40

Secondary Value of Shipments Generated in the Regional Study Area -- 1979-1990
(Millions of 1975 Dollars)

	1979	1981	1986	1990
Indirect				
Construction-Related	$ 1.6	$ 18.9	$ 12.6	$ 0
Operations-Related	0	0	31.9	53.0
Total Indirect	$ 1.6	$ 18.9	$ 44.5	$ 53.0
Induced				
Construction-Related	$ 14.7	$ 58.5	$ 43.2	$ 0
Operations-Related	0	25.0	102.0	151.8
Total Induced	$ 14.7	$ 83.5	$ 145.2	$ 151.8
Total Impact	$ 16.3	$ 102.4	$ 189.7	$ 204.8
Baseline	$7,571.3	$7,818.6	$8,211.8	$8,526.4
Total Impact as a Percent of Baseline	-	1%	2%	2%

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

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FINAL ENVIRONMENTAL IMPACT STATEMENT. PERMIT APPLICATION BY UNI--ETC(U)
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construction sectors. Since the plant-related impacts are weighted toward wholesale/retail trade, the overall percent increase in value of shipments is greater than the overall percent increase in payrolls. This occurs even though payroll impacts include additional induced activity not included in estimates of value of shipments. For example, in 1990 trade accounts for less than 30 percent of the plant-related secondary payroll but 55 percent of the secondary value of shipments. The 1990 sectoral distribution of secondary payrolls and value of shipments for the Regional Study Area is shown in Table 4-41. The secondary value of shipments generated in the Local Study Areas and Principal Study Areas in Ohio and Pennsylvania is presented in Tables 4-42 through 4-45.

Cost-of-Living

4.92
Data presented in the Regional Economic Baseline indicate that changes in the overall cost-of-living in the Regional Study Area have not been significantly different from changes which have occurred at the national level or in surrounding metropolitan areas. With development of the Lakefront Plant, it is likely that the cost-of-living in the area would increase somewhat more rapidly than might otherwise be expected under baseline conditions. The principal component of consumer prices likely to be most affected by the plant and related development would be housing. As large numbers of in-migrants enter the area in 1981-1982 and 1986-1987, there is likely to be a short-term lag in providing sufficient housing, particularly in the Conneaut area. Therefore, competition for both existing and new homes would likely increase, thus tending to drive prices up. Even though a balance between supply and demand is expected to be achieved over the long-term, housing prices are unlikely to decline to baseline levels unless there were significant over-building and a sharp rise in the vacancy rate. Such a condition is not anticipated. In addition, a tight housing market could raise mortgage interest rates, further increasing the costs of housing. Other components of the cost-of-living (e.g., clothing, medical) may also increase slightly faster because of higher wage levels among plant workers. Such additional increases in these sectors would likely be quite limited since residents would be able to transfer their spending to nearby urban areas if local prices were much higher than those in other areas. The cost-of-living could also be affected by higher average incomes, particularly in the Local Study Area. The relatively high wages of plant workers could attract retail businesses selling higher quality or more expensive products and cause existing stores to stock a greater proportion of higher-priced items. As the average price of goods and services increases, the average family expenditure level would also increase. At the same time, lower-priced items would become relatively less available.

Table 4-41

Sectoral Distribution of Secondary Payrolls and Value of Shipments for the Regional Study Area -- 1990 (Millions of 1975 Dollars)

	Impact				Baseline			
	Payroll[1]		Value of Shipments		Payroll		Value of Shipments	
	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent
Total	$ 48.8	100%	$204.8	100%	$2,261.9	100%	$8,526.4	100%
Manufacturing	6.0	12	21.8	11	1,024.2	45	3,763.8	44
Non-Manufacturing	42.8	88	183.0	89	1,237.7	55	4,762.6	56
Wholesale/Retail Trade	11.6	28	111.8	55	306.7	14	2,788.2	33
Services	9.0	18	22.8	11	378.7	17	933.9	11
Transportation, Communications and Utilities	8.1	17	23.5	11	171.0	7	569.3	7
Construction	8.0	16	23.0	11	132.6	6	349.0	4
Agriculture/Mining	0.4	1	1.9	1	22.0	1	122.2	1
Government	3.7	8	-	-	226.7	10	-	-

(1) Includes payrolls generated in infrastructure construction, medical services, and other population-based activities.

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-42

Secondary Value of Shipments in the Ohio Local Study Area -- 1979-1990
(Millions of 1975 Dollars)

	1979			1981			1986			1990		
	Total Impact	Baseline	Percent Impact	Total Impact	Baseline	Percent Impact	Total Impact	Baseline	Percent Impact	Total Impact	Baseline	Percent Impact
Total Shipments	$ 4.2	$ 207.0	2%	$24.6	$ 213.2	12%	$60.8	$ 225.0	27%	$60.8	$ 234.4	32%
Manufacturing	-	103.5	-	-	106.9	-	0.1	110.6	5	0.2	113.6	9
Fabricated Metals/ Machinery	-	49.0	-	-	50.2	-	0.1	52.7	-	0.2	54.8	-
Chemicals/Rubber	-	21.9	-	-	22.8	-	-	23.5	-	-	24.0	-
Other	-	32.6	-	-	33.9	-	-	34.4	16	-	34.8	28
Non-Manufacturing	4.2	103.5	4	24.6	106.3	23	55.2	114.4	48	65.3	120.8	54
Commercial(1)	3.7	61.2	6	22.3	63.5	35	40.3	69.8	58	44.0	74.9	59
Other(2)	0.4	15.3	3	1.8	15.6	12	3.5	16.5	21	3.9	17.2	23
Transportation Services	-	19.4	-	0.2	19.6	1	3.9	20.3	19	6.3	20.8	30
Construction	0.1	7.6	1	0.3	7.6	4	7.5	7.8	96	11.1	7.9	141

(1) Commercial includes wholesale/retail trade, F.I.R.E., and selected services.

(2) Other includes only utilities and communications.

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-43

Secondary Value of Shipments in the Pennsylvania Local Study Area -- 1979-1990 (Millions of 1975 Dollars)

	1979	1981	1986	1990
Indirect (Maintenance Construction and Slag Processing)	$ 0	$ 0	$12.5	$20.2
Induced (Wholesale/Retail Trade and Services	0.4	2.4	4.2	4.3
Total Secondary Impact	$0.4	$2.4	$16.7	$24.5

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-44

Secondary Value of Shipments in the Ohio Principal Study Area -- 1979-1990
(Millions of 1975 Dollars)

	1979			1981			1986			1990		
	Total Impact	Baseline	Percent Impact	Total Impact	Baseline	Percent Impact	Total Impact	Baseline	Percent Impact	Total Impact	Baseline	Percent Impact
Total Shipments	$ 7.5	$1,117.4	1%	$44.1	$1,157.8	4%	$89.5	$1,220.0	8%	$101.3	$1,273.4	9%
Manufacturing	0.1	517.7	-	0.5	540.1	-	2.5	556.9	1	3.7	570.4	2
Non-Manufacturing	7.4	599.7	1	43.6	617.7	7	87.0	665.1	13	97.6	703.0	14
Wholesale/Retail Trade	5.5	324.4	2	32.0	334.3	10	56.8	360.2	16	60.8	380.9	16
Services(1)	1.0	89.8	1	7.0	94.8	7	10.8	108.6	10	10.7	119.6	9
Transportation, Communications, and Utilities	0.7	132.0	1	3.7	134.4	3	10.6	139.9	8	13.7	144.4	9
Construction	0.1	36.5	-	0.5	37.8	1	7.9	41.4	19	11.5	44.2	26
Agriculture/Mining	0.1	17.0	1	0.4	16.4	2	0.9	15.0	6	0.9	13.9	6

(1) Includes F.I.R.E. and selected services.

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-15

Secondary Value of Shipments in the Pennsylvania Principal Study Area -- 1979-1990
(Millions of 1975 Dollars)

	1979			1981			1986			1990		
	Total Impact	Baseline	Percent Impact	Total Impact	Baseline	Percent Impact	Total Impact	Baseline	Percent Impact	Total Impact	Baseline	Percent Impact
Total Shipments	$ 8.8	$4,424.6	-	$58.3	$4,575.7	1%	$100.2	$4,853.1	2%	$103.5	$5,075.0	2%
Manufacturing	1.4	2,119.7	-	14.0	2,195.3	1	19.7	2,310.5	1	18.1	2,402.6	-
Non-Manufacturing	7.4	2,304.9	-	44.3	2,380.4	2	80.5	2,542.6	3	85.4	2,672.4	3
Wholesale/Retail Trade	5.2	1,425.4	-	30.9	1,475.1	2	50.6	1,568.7	3	51.0	1,643.6	3
Services(1)	1.1	470.1	-	7.9	484.2	2	12.2	519.3	2	12.1	547.4	2
Transportation, Communications and Utilities	0.9	198.5	-	4.6	203.7	2	8.9	216.0	4	9.8	226.0	4
Construction	0.1	152.4	-	0.5	161.2	-	7.9	187.0	4	11.5	207.6	6
Agriculture/Mining	0.1	58.5	-	0.4	56.2	1	0.9	51.6	2	1.0	47.8	2

(1) Includes F.I.R.E. and selected services.

Source: Regional Economic Structure baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

4.93
Although some additional cost-of-living increases can be expected, the overall impact on area residents should not be substantial. A large industrial development in an isolated rural area could create a "boom town" atmosphere with accompanying price inflation. However, residents of the Regional Study Area have alternatives to paying high local costs. For example, if housing in the Local Study Area becomes significantly more expensive than expected under baseline conditions, in-migrants could choose to live farther from the plant site, either permanently or temporarily. Similarly, some in-migrants could be commuters or weeklies for a short period of time until they were able to find a reasonably-priced new home in the study area. Also, if housing costs in the immediate plant area are substantially higher than those in other parts of the Principal Study Area, many new residents could choose a somewhat longer drive to work in order to be able to afford the type of home they prefer. Increases in the cost-of-living would most likely affect low income and elderly households. Higher housing costs would provide fewer opportunities for relatively low-income younger families who wanted to leave apartments and purchase a single-family house. Similarly, elderly persons on fixed incomes might be affected by higher rents for apartments or higher prices for certain other items, particularly since they would not benefit from higher average wages in the area. However, it is also possible that elderly residents who own a house which they no longer need because their children have moved away could realize a higher price for their property by selling it to an in-migrant family. If this occurred, these residents could afford a higher-rental apartment or would be able to leave the area for retirement.

Long-Term Development Possibilities in the Regional Study Area

a) Indirect Activity

4.94
In view of the expected product mix and geographic location of the proposed facility, it is not likely that steel-consuming industries would locate in the Regional Study Area during the projection period. However, shipbuilding and railroad car manufacture were identified as customer industries which might be attracted to the area once Step II plate production is well established. With the addition of Step II capacity, the Lakefront Plant is expected to produce some 1.5 million tons of steel plate annually. Since the shipbuilding industry currently consumes 13 percent of all steel plate produced in the United States and the proposed steel plant will be located on Lake Erie, it is possible that a commercial shipbuilding operation or a maintenance and overhaul yard could be attracted to the area sometime after 1990. Similarly, railroad car manufacturing consumes about eight percent of steel plate production; with major rail lines

passing through Conneaut, the area could be attractive to such an industry. While it is not possible to predict if or when such developments might occur, activities of these types could generate important additional employment and payroll effects in the Principal Study Area. Other possible long-term indirect developments could occur in small manufacturing activities. While it is not likely that manufacturers of steelmaking materials and equipment would relocate to the Regional Study Area solely because of the Lakefront Plant development, it is possible that a firm seeking a new plant location could choose this area in hopes of supplying part of U.S. Steel requirements while relying on the area's extensive transportation infrastructure to reach other customers. A possible example of this type of development would be manufacturing of repair parts or other equipment used at the plant. It is likely that plant-related activity in these industries would take the form of a warehousing operation in the Local Study Area. However, if manufacturing firms were looking for a site for a new plant, the Regional Study Area could be attractive because of potential sales to the proposed Lakefront Plant.

b) Induced Activity

4.95
Although long-term development of additional indirect industries in the Regional Study Area must be considered highly speculative, it is more reasonable to project continued expansion of the induced (consumer-related) industries beyond 1990. The ratio of induced activity to direct and indirect payrolls is expected to increase slowly during the 1979-1990 period as a greater fraction of the consumer's dollar remains in the Regional Study Area. This trend is likely to continue to some extent beyond 1990, as additional establishments are attracted to the area.

Social Environment

Population Projections

4.96
During the permit application process, various Federal, State, and local governmental agencies, public and private interest groups, and members of the general public criticized the projected population figures used in this Environmental Impact Statement. This section presents the projections that the applicant feels would most likely occur.

4.97
Staff notes that many population projections are possible, based on the variables involved and the number of different scenarios that

exist, some of which are more likely to occur than others. As this final Environmental Impact Statement was prepared, a number of governmental agencies submitted independent population projections which in their opinion provided a more representative portrayal of the impacts associated with the proposed Lakefront plant.

4.98
The applicant projects an increase of 15,800 new residents for the Regional Study Area by the year 1990, with a possible range from a low of 11,060 to a high of 20,540. The Ashtabula County Planning Commission projects an increase of 16,181 to 26,265 new residents for Ashtabula County alone. The Crawford County Planning Commission predicts 44,600 new residents for the entire Regional Study Area while the Northwest Pennsylvania Futures Committee, Inc., projects 45,500 to 58,500 and the County Executive, Erie (PA) County predicts 37,187 to 47,812 new residents. The methods used in deriving these figures are contained in the following reports:

Ashtabula County Planning Commission, Alternative Futures for Ashtabula County: A Study of Impact Scenarios, October 1978

Crawford County Planning Commission, Correspondence, 14 August 1978

Northwest Pennsylvania Futures Committee, Correspondence, 22 August 1978

Office of the County Executive, Russell D. Robison, Preliminary Projected Population, U.S. Steel Impact Area, 17 October 1978

These documents are available for public review at the Corps of Engineers offices in Buffalo, NY, and Cleveland, OH, along with the Erie City and County Public Library, Erie, PA, and the Carnegie Public Library, Conneaut, OH.

4.99
Population projections are difficult to categorize as accurate or inaccurate since they are highly speculative at best. The various estimates derived can be easily prejudiced by accentuating certain baseline data input over others, incorporating the goals and personal references of planning professionals, and other factors. All of the population scenarios provided by the review agencies, as well as those provided by the applicant, can be placed in this category.

4.100
Due to the number of problems associated with the incorporation of data from one modeling scheme to the next we have chosen to leave the applicant's projection intact as an illustrative example of secondary

development impact. However, to present the reviewer with some perspective of the effect the various alternatives would have, the figures provided in the socio-economic section of this environmental impact statement can be changed by using the following multipliers:

U.S. Steel Corporation	- High Range =	1.30 (20,540/15,800)
	Low Range =	.70 (11,060/15,800)
Ashtabula County Planning Commission	- High Range =	2.77 (26,265/9,480)
	Low Range =	1.71 (16,181/9,480)
Crawford County Planning Commission	=	2.82 (44,600/15,800)
Northwest Pennsylvania Futures Committee	- High Range =	3.70 (58,500/15,800)
	Low Range =	2.88 (45,500/15,800)
County Executive Erie (PA) County	- High Range =	3.03 (47,812/15,800)
	Low Range =	2.35 (37,187/15,800)

The following example is presented to illustrate this method:

4.101
This Environmental Impact Statement indicates that the overall impact on the public school systems located in the Local and Principal Study Areas would increase enrollment by 3,280 students over baseline projections. Utilizing the applicant's range of ± 30 percent, the school enrollment impact could vary from 2,296 (.70 X 3,280) to 4,264 (1.30 X 3,280) pupils. Crawford County Planning Commission projections would be 9,250 (2.82 X 3,280); Northwest Pennsylvania Futures Committee would range from 9,446 (2.88 x 3,280) to 12,136 (3.70 X 3,280); County Executive, Erie (PA) County from 7,708 (2.35 X 3,280) to 9,938 (3.03 X 3,280); and Ashtabula County Planning Commission from 5,609 (1.71 X 3,280) to 9,086 (2.77 X 3,280). The reviewer is again cautioned that these numbers are to be used only for illustrative purposes and reflect what may happen and not necessarily what will happen.

4.102
Staff felt that governmental and quasi-public agencies who have submitted substantial criticisms and/or developed other detailed analysis of population projections should meet and attempt to resolve their differences. In this respect we requested the Federal Regional Council, Region III, to conduct a meeting with representatives of these agencies to develop, by consensus, a single set of criticisms that the Corps of Engineers could submit to the applicant for response. The minutes of the 13 September 1978 meeting, along with the applicant's response, is appended to this statement. Unless otherwise noted, the actions recommended in the minutes represent the

consensus of the participants and do not necessarily reflect the views of the Corps of Engineers or the Federal Regional Council. In the case of issues not specifically stated in the minutes, the consensus of the participants were that (1) the material presented in the Environmental Impact Statement was adequate or acceptable and that (2) any shortcomings were too inconsequential to require further attention.

4.103
In view of the circumstances outlined above, the estimates have not been altered to reflect the data contained in the various alternative projections. This section has been modified where appropriate to resolve inaccuracies, inconsistencies, or errors in the applicant's original analysis which follows:

Population

a) Population Impacts

Total Principal Study Area

4.104
The greatest overall population impact is expected to occur in 1990, when about 15,800 new residents would be living in the Regional Study Area. About 60 percent of these residents are expected to live in Ohio, with the remaining 40 percent in Pennsylvania. The incremental increase in area residents would be only four percent above the projected 1990 baseline population of the Principal Study Area as shown in Table 4-46. The construction-related population is expected to peak in 1981 at 5,235 people. Since construction of the proposed plant is expected to be completed in 1987, there would be no new construction-related residents in 1988 and the following years. However, it is likely that some construction workers who had already moved into the Principal Study Area would remain if they are able to find employment at other projects in or near the Principal Study Area. Similarly, although there is no construction activity scheduled at the site in 1983, workers who have moved into the Study Area and expect to be employed at the site during the second step of construction will likely remain and seek employment at other construction projects in the area. Although the number of such workers cannot be accurately estimated, it is possible that the construction-related population estimates for the years after 1981 slightly understate actual plant-related population increases. Under a worst case assumption, all 3,235 construction-related movers expected in 1981 would remain in the Principal Study Area throughout the projection period. This would increase the 1990 maximum population impact to about 19,050, or five percent above the projected baseline population. However, it is highly unlikely that all of

Table 4-46

Total New Resident Population in the Principal Study Area -- 1979-1990[1]

	1979	1981	1986	1990
Ohio Principal Study Area				
Construction-Related	150	2,360	1,160	-
Operations-Related	-	1,620	7,280	9,785
Total Impact	150	3,980	8,440	9,785
Baseline	75,910	76,460	77,940	78,900
Total Impact As a Percent of Baseline	*	5%	11%	12%
Pennsylvania Principal Study Area				
Construction-Related	210	2,875	1,400	-
Operations-Related	-	1,025	4,395	6,025
Total Impact	210	3,900	5,795	6,025
Baseline	263,190	266,780	276,240	284,000
Total Impact As a Percent of Baseline	*	1%	2%	2%
Total Principal Study Area				
Construction-Related	360	5,235	2,560	-
Operations-Related	-	2,645	11,675	15,810
Total Impact	360	7,880	14,235	15,810
Baseline	339,100	343,240	354,180	362,900
Total Impact As a Percent of Baseline	*	2%	4%	4%

(1) Includes Weeklies

*Less than 0.5% -- all percents are rounded.

Source: Population baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

these families would remain in the area unless substantial additional construction activity were to occur in the area beyond that which is currently anticipated. The distribution of construction-related new residents between movers and weeklies is shown in Table 4-47. Construction movers are expected to be workers employed throughout most of the facility's construction phase. As a result, movers will account for almost all of the construction-related population impacts in the initial years of plant construction, but represent a smaller share as short-term peak manpower requirements must be met later on. These short-term peak needs are more likely to be met by weeklies. It should be noted that the construction-related new population is expressed in terms of annual average new residents. Although the number of movers is not expected to be significantly different on an annual or quarterly basis, the number of weekly residents is likely to vary from the annual average in any given quarter. This occurs because weekly workers are expected to be needed only in quarters of peak manpower demand and would not be likely to relocate because of a short-term employment opportunity. Therefore, a weekly population of 100 workers on an annual basis may, in fact, represent employment of 400 weekly workers in one quarter of the year.

4.105
The operations-related population impact is expected to reach a maximum level of 15,810 persons in 1990. Direct operation of the facility is expected to account for the vast majority of new residents, although a small percentage of secondary workers (10 percent of workers in indirect activities and one percent of workers in induced activities) are assumed to be managerial personnel transferred to new facilities and operations in the Principal Study Area. As noted, all operations-related workers are expected to be movers and become permanent residents of the Study Area.

Residential Allocation of the In-Migrant Population

Construction-Related

4.106
The majority of construction-related movers are expected to live in Conneaut, Kingsville Township and Village, Fairview Township and Borough, Millcreek Township, and the Erie City area. This conclusion is based on several factors.

- The attractiveness of Fairview, Millcreek, and Kingsville in terms of housing developments, recreational possibilities, and character of the areas;

- The very large modern shopping facilities in Millcreek Mall and other shopping plazas on Routes 5 and 20 which

Table 4-47

Construction-Related New Resident Population in the Principal Study Area -- 1979-1990

	1979	1981	1986	1990
Ohio Principal Study Area				
Construction-Related Movers	140	1,445	625	-
Construction-Related Weeklies	10	915	535	-
Total Construction Related	150	2,360	1,160	-
Pennsylvania Principal Study Area				
Construction-Related Movers	210	1,790	765	-
Construction-Related Weeklies	-	1,085	635	-
Total Construction Related	210	2,875	1,400	-
Total Principal Study Area				
Construction-Related Movers	350	3,235	1,390	-
Construction-Related Weeklies	10	2,000	1,170	-
Total Construction Related	360	5,235	2,560	-
Total Principal Study Area				
Movers as a Percent of Construction-Related	97%	62%	54%	
Weeklies as a Percent of Construction-Related	3%	38%	46%	

Source: Population baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

will unquestionably attract movers to Fairview Millcreek, and

- The generalized preference for suburban life common among construction workers as long as ample infrastructure amenities and shopping facilities are available within moderate driving distance.

4.107
However, relatively few movers are expected to settle in Ashtabula Township, Ashtabula City, Saybrook Township, Springfield, and the Girard Area for the following reasons:

- Saybrook and Springfield Townships have insufficient housing development and infrastructure at this time to prove attractive to movers early in the construction period,

- Ashtabula Township is somewhat similar to Saybrook and Springfield in that it is relatively undeveloped and also has a considerable traffic flow from the industrial installations nearby;

- Ashtabula City has a preponderance of row houses that are not normally preferred by new home owners; and

- The Girard Area has a mixture of rural, suburban, and small town characteristics, with housing stocks of each type. Proximity to the construction site on the Pennsylvania side of the line was believed to be only a minor advantage. While there would be some demand for this kind of living style, this community is not expected to be the residential choice of a substantial proportion of construction movers.

4.108
The principal consideration affecting the residential choice of construction-related weeklies is the availability of low-cost temporary housing accommodations. The first choice of these workers is expected to be inexpensive motel units, with apartments, rooming houses, and mobile homes as alternatives. Therefore, the weeklies were allocated among the communities of the Principal Study Area based primarily on the availability of suitable accommodations.

Operations-Related

4.109
It is anticipated that a greater share of the operations-related new population would choose to live in the Local Study Area than would be

the case for construction workers. The major assumptions underlying the residential allocation of operations-related new residents are:

- Population distribution in the Principal Study Areas should continue to move away from the established urban centers (e.g., Ashtabula City, Erie), raising the level of suburbanization.

- Secondly, growth within the Coastal Communities will be supported by relatively greater degree of infrastructure already in place or planned and greater ease of access to existing work and commercial centers. In addition, excellent east-west highway transport will further support growth along the coast, providing impetus to the suburbanization trend.

- The population growth in communities south of the Coastal Area will be limited by more prolonged, severe, and inclement winter weather conditions, and a lack of adequate public and private infrastructure.

- The Ohio Coastal Communities should benefit from a slightly lower overall resident tax burden than in Pennsylvania and a greater amount of infrastructure in place.

- Growth in Conneaut will be spurred by available and planned additions to infrastructure, proximity to the plant site, and the potentially favorable impact which the Lakefront facility could have on the total assessed property valuation and tax rate in this community.

- Ashtabula City should continue to lose population, largely to the more suburban/rural surrounding communities. Plans to extend infrastructure in Ashtabula Township should act to attract new in-migrant workers.

- The infrastructure, type of housing, socioeconomic character, and recreational-related amenities available in communities such as Saybrook, Kingsville, and Fairview should spur the attraction of high income in-migrants.

- Millcreek should continue as a prime residential location, given its proximity to Erie, many large and modern/retail/ commercial outlets, its housing stock, and infrastructure base.

4.110
The distribution of the new population by community is shown in Table 4-48. As noted above, the share of operations-related new residents

Table 4-48

Percent Distribution of New Resident Population by Community -- 1979-1990

	Construction-Related			Operations-Related			Total Impact			
	1979	1981	1986	1981	1986	1990	1979	1981	1986	1990
Total Principal Study Area	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Ohio Principal Study Area	41.6	45.1	45.2	61.3	62.4	61.9	41.6	50.5	59.3	61.9
Conneaut City	7.4	9.7	9.7	20.2	32.0	33.3	7.4	13.2	27.8	33.3
Kingsville Township and Village	19.5	9.0	9.1	13.6	8.2	7.6	19.5	10.6	8.4	7.6
Ashtabula Township	--	4.6	4.6	10.2	11.0	10.7	--	6.5	9.9	10.7
Ashtabula City	--	6.6	6.9	1.7	3.1	3.4	--	4.9	3.8	3.4
Saybrook Township	4.9	5.0	4.9	7.9	2.3	1.7	4.9	6.0	2.8	1.7
Other Principal Study Area	9.8	10.2	10.4	7.7	5.8	5.1	9.8	0.3	6.6	5.1
Pennsylvania Principal Study Area	58.4	54.9	54.8	38.7	37.6	38.1	58.4	49.5	40.7	38.1
Springfield Township and East Springfield Borough	--	2.6	2.3	11.7	19.2	17.9	--	5.7	16.0	17.9
Girard Area	4.9	5.0	4.7	8.3	7.7	7.6	4.9	6.0	7.2	7.6
Fairview Township and Borough	14.6	8.3	8.3	7.7	4.0	3.4	14.6	8.1	4.8	3.4
Millcreek Township	14.7	18.8	19.8	3.6	2.3	3.3	14.7	13.7	5.5	3.3
Other Principal Study Area	24.2	20.2	19.7	7.4	4.4	6.0	24.2	16.0	7.2	6.0

Source: Population baseline, Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

expected to live in the Local Study Area is significantly larger than that for construction-related. By 1990, slightly more than half of the new residents are expected to be living in Conneaut and Springfield, with another 38 percent in the other Coastal Communities. Population increases outside of the Coastal Area are expected to amount to slightly more than 10 percent of the new residents, or about 1,750 people.

Local Study Area

4.111
About half of the new resident population is expected to live in the Local Study area by 1990. While a much larger absolute population increase is expected in Conneaut, the relative impact in Springfield will be much greater because of its small projected baseline population (refer to Table 4-49). Conneaut is expected to receive the largest share of new residents in the Principal Study Area due to the location of the Lakefront Plant itself, the development of secondary industries, and potential favorable impact on the city's tax rate and level of public services. With the Lakefront Plant and related development, some 5,265 new residents are expected to locate in Conneaut by 1990 (33 percent of the projected baseline population). Throughout the projection period, most of the new resident population will be movers while a maximum of only 200 weeklies is expected in 1981 (refer to Tables 4-50 and 4-51). Although the 1990 plant-related population increase in Springfield is expected to be 2,830 persons, or only about half the new population expected in Conneaut, the relative impact would be significantly larger and is calculated to be 71 percent of projected baseline population. Throughout the projection period, all of the population increase in this community is expected to be generated by movers. The expected population impacts in the Local Study Area for each year of the projection period are illustrated in Figure 4-12(a).

Ohio Principal Study Area

4.112
Data illustrating the population impact of the proposed U.S. Steel facility and related development on the Ohio Principal Study Area and the key Coastal Communities are presented in Tables 4-52 through 4-54 and Figure 4-12(b). The areas outside the Local Study Area differ in their expected population impact in that they have a greater proportion of construction-related residents as opposed to operations-related. For example, in 1981, there are expected to be a total of 2,630 construction-related new residents in the Ohio Principal Study Area, and 1,620 operations-related people. In percentage terms, the 1981 impact will be 59 percent construction-related and 42 percent

Table 4-49

Total New Resident Population in the Local Study Area -- 1979-1990

	1979	1981	1986	1990
Conneaut				
Construction-Related	25	505	250	--
Operations-Related	--	535	3,720	5,265
Total Impact	25	1,040	3,970	5,265
Baseline	14,980	15,130	15,520	15,800
Total Impact as a Percent of Baseline	*	7%	26%	33%
Springfield				
Construction-Related	-	135	60	--
Operations-Related	-	310	2,230	2,830
Total Impact		445	2,290	2,830
Baseline	3,360	3,465	3,780	4,000
Total Impact as a Percent of Baseline	--	13%	61%	71%

*Less than 0.5%

Source: Population baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-50

Total Mover Population in the Local Study Area -- 1979-1990

	1979	1981	1986	1990
Conneaut				
Construction-Related	15	305	135	--
Operations-Related	--	535	3,720	5,265
Total Impact	15	840	3,855	5,265
Baseline	14,980	15,130	15,520	15,800
Total Impact as a Percent of Baseline	*	6%	25%	33%
Springfield				
Construction-Related	--	135	60	--
Operations-Related	--	310	2,230	2,830
Total Impact	--	445	2,290	2,830
Baseline	3,360	3,465	3,780	4,000
Total Impact as a Percent	--	13%	61%	71%

*Less than 0.5%.

Source: Population baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

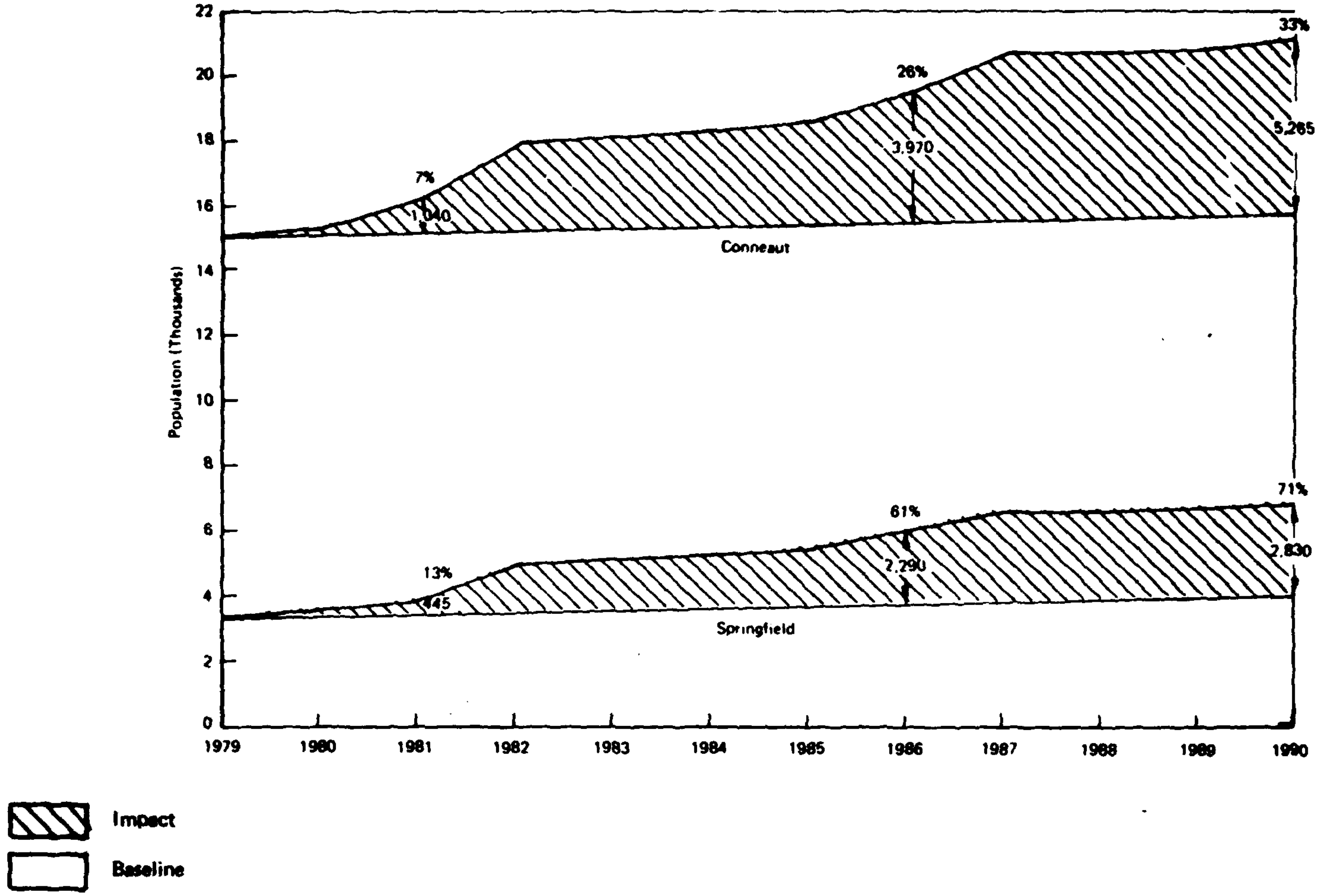
Table 4-51

Total Weekly Population in the Local Study Area -- 1979-1990

	1979	1981	1986	1990
Conneaut				
Total Impact[(1)]	10	200	115	-
Baseline	14,980	15,130	15,520	15,800
Total Impact as a Percent of Baseline	--	1%	1%	--
Springfield				
Total Impact[(1)]	--	--	--	--
Baseline	3,360	3,465	3,780	4,000
Total Impact as a Percent of Baseline	--	--	--	--

(1) All weeklies are construction-related.

Source: Population baseline; Construction Labor Requirements and Characteristics Working Paper; SIMPACT IV Model.



Source: Population baseline: Construction Labor Requirements and Characteristics and Economics and Demographics Operations *Phase Working Papers;* SIMPACT IV Model.

Figure 12(a) **POPULATION IMPACTS IN THE LOCAL STUDY AREA**

Table 4-52

Total New Resident Population in the Ohio Principal Study Area and Key Coastal Communities

	1970	1981	1986	1990
Ohio Principal Study Area[1]				
Construction-Related	150	2,360	1,160	-
Operations-Related	-	1,620	7,280	9,785
Total Impact	150	3,980	8,440	9,785
Baseline	75,910	76,460	77,940	78,900
Total Impact As a Percent of Baseline	*	5%	11%	12%
Kingsville Township and Village				
Construction-Related	70	475	235	-
Operations-Related	-	360	960	1,205
Total Impact	70	835	1,195	1,205
Baseline	5,060	5,240	5,690	6,050
Total Impact As a Percent of Baseline	1%	16%	21%	20%
Ashtabula Township				
Construction-Related	-	245	120	-
Operations-Related	-	270	1,290	1,690
Total Impact	-	515	1,410	1,690
Baseline	7,840	7,960	8,260	8,500
Total Impact As a Percent of Baseline	-	6%	17%	20%
Ashtabula City				
Construction-Related	-	345	175	-
Operations-Related	-	45	365	540
Total Impact	-	390	540	540
Baseline	23,620	23,280	22,410	21,650
Total Impact As a Percent of Baseline	-	2%	2%	2%
Saybrook Township				
Construction-Related	20	260	120	-
Operations-Related	-	210	270	270
Total Impact	20	470	390	270
Baseline	7,260	7,550	8,330	8,900
Total Impact As a Percent of Baseline	*	6%	5%	3%
Rest of Ohio Principal Study Area				
Construction-Related	35	530	260	-
Operations-Related	-	200	675	815
Total Impact	35	730	935	815
Baseline	17,150	17,300	17,760	18,000
Total Impact As a Percent of Baseline	*	4%	5%	5%

(1) Includes Ohio Local Study Area - Conneaut City.

*Less than .5

Source: Population baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-53

Total Mover Population in the Ohio Principal Study Area and Key Coastal Communities -- 1979-1990

	1979	1981	1986	1990
Ohio Principal Study Area [1]				
Construction-Related	140	1,445	630	--
Operations-Related	--	1,620	7,280	9,785
Total Impact	140	3,065	7,910	9,785
Baseline	75,910	76,460	77,940	78,900
Total Impact As a Percent of Baseline	*	4%	10%	12%
Kingsville Township & Village				
Construction-Related	70	370	165	--
Operations-Related	--	360	960	1,205
Total Impact	70	730	1,125	1,205
Baseline	5,060	5,240	5,690	6,050
Total Impact As a Percent of Baseline	1%	14%	20%	20%
Ashtabula Township				
Construction-Related	--	145	60	--
Operations-Related	--	270	1,290	1,690
Total Impact	--	415	1,350	1,690
Baseline	7,840	7,960	8,260	8,500
Total Impact As a Percent of Baseline	--	5%	16%	20%
Ashtabula City				
Construction-Related	--	145	60	--
Operations-Related	--	45	365	540
Total Impact	--	190	425	540
Baseline	23,620	23,280	22,410	21,650
Total Impact As a Percent of Baseline	--	1%	2%	2%
Saybrook Township				
Construction-Related	20	160	60	--
Operations-Related	--	210	270	270
Total Impact	20	370	330	270
Baseline	7,260	7,550	8,300	8,900
Total Impact As a Percent of Baseline	*	5%	4%	3%
Rest of Ohio Principal Study Area				
Construction-Related	35	320	150	--
Operations-Related	--	200	675	815
Total Impact	35	520	825	815
Baseline	17,150	17,300	17,760	18,000
Total Impact As a Percent of Baseline	*	3%	5%	5%

[1] Includes Ohio Local Study Area - Conneaut City.

*Less than 0.5%.

Source: Population baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-54

Total Weekly Population in the Ohio Principal Study Area and Key Coastal Communities -- 1979-1990

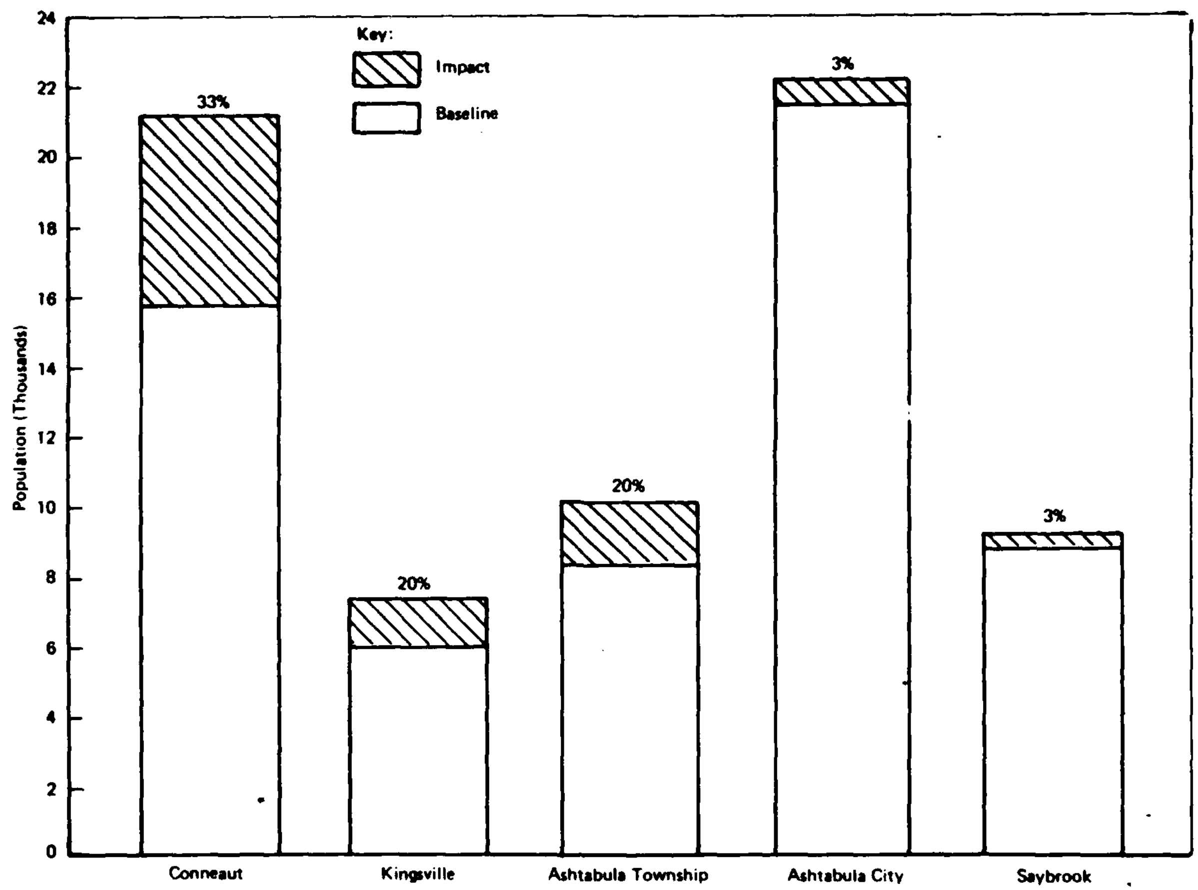
	1979	1981	1986	1990
Ohio Principal Study Area(1)				
Total Impact(2)	10	915	530	-
Baseline	75,910	76,460	77,940	78,900
Total Impact As a Percent of Baseline	*	1%	1%	-
Kingsville Township & Village				
Total Impact(2)	-	105	70	-
Baseline	5,060	5,240	5,690	6,050
Total Impact As a Percent of Baseline	-	2%	1%	-
Ashtabula Township				
Total Impact(2)	-	100	60	-
Baseline	7,840	7,960	8,260	8,500
Total Impact As a Percent of Baseline	-	1%	1%	-
Ashtabula City				
Total Impact(2)	-	200	115	-
Baseline	23,620	23,280	22,410	21,650
Total Impact As a Percent of Baseline	-	1%	1%	-
Saybrook Township				
Total Impact(2)	-	100	60	-
Baseline	7,260	7,550	8,300	8,900
Total Impact As a Percent of Baseline	-	1%	1%	-
Rest of Ohio Principal Study Area				
Total Impact(2)	-	210	110	-
Baseline	17,150	17,300	17,760	18,000
Total Impact As a Percent of Baseline	-	1%	1%	-

*Less than 0.5%--all percents are rounded.

(1) Includes Ohio Local Study Area - Conneaut City.

(2) All impact is construction-related.

Source: Population baseline; Construction Labor Requirements and Characteristics Working Paper; SIMPACT IV Model.



Source: Population baseline; Economics and Demographics Operations Phase Working Paper; SIMPACT IV Model.

Figure 12(b) **POPULATION IMPACTS IN THE OHIO PRINCIPAL STUDY AREA – 1990**

operations-related for the entire Study Area. However, construction-related increases are expected to account for 89 percent of Ashtabula City's 1981 total population gain and 73 percent in the rest of the Ohio Principal Study Area. The resulting increases in community population levels closely reflect the assumptions underlying the allocations. The greatest population impacts would be experienced in the communities closest to the proposed site. In both Kingsville Township and Village and Ashtabula Township, the population increase by 1990 is equal to 20 percent of the projected baseline population, although the absolute number of new residents will be larger in the latter community. However, increases in Kingsville are expected to be greater than those in Ashtabula Township in the 1979-1987 period because of a larger number of construction workers in-migrating to this community. In all the other communities in the Ohio Principal Study Area, the long-term impact of the proposed facility is expected to be less than five percent of the projected baseline population.

Pennsylvania Principal Study Area

4.113
The population impact of the proposed U.S. Steel facility and related development in the Pennsylvania Principal Study Area is projected to be significantly less than in Ohio. In 1979, the impact in terms of new residents is expected to total 210 construction-related people, which is just 0.1 percent of the projected baseline population. By 1990, the total increase is anticipated to equal 6,025 people, only two percent of baseline population (refer to Table 4-55). The breakdown between mover and weekly population impacts is shown in Tables 4-56 and 4-57. Population impacts on the Coastal Communities for 1990 are illustrated in Figure 4-12(c). Outside of the Local Study Area, the Girard Area is expected to experience the greatest population impact (relative to baseline) from the steel facility and associated development. The greatest impact is expected to occur in 1990, when 1,195 operations-related people are expected to be residing in the Girard Area. This is 11 percent of the projected 1990 baseline population, the highest percentage among the Pennsylvania Coastal Communities. In absolute terms, the population impact in Pennsylvania is expected to be greatest in Millcreek Township and in communities other than the selected Coastal Communities. In Millcreek Township, the bulk of the impact is assumed to occur in 1981, as 980 construction-related people and 95 operations people are expected to be residing in Millcreek Township. Of the construction-related people, 49 percent will be movers, while 51 percent will be weeklies (refer to Tables 4-56 and 4-57). However, because Millcreek Township is already relatively large and populous, the total 1981 impact is only three percent of the projected baseline.

Table 4-55

Total New Resident Population in the Pennsylvania Principal Study Area and Key Coastal Communities -- 1979-1990

	1979	1981	1986	1990
Pennsylvania Principal Study Area(1)				
Construction-Related	210	2,875	1,400	-
Operations-Related	-	1,025	4,395	6,025
Total Impact	210	3,900	5,795	6,025
Baseline	263,190	266,780	276,240	284,000
Total Impact As a Percent of Baseline	*	1%	2%	2%
Girard Area				
Construction-Related	20	260	120	-
Operations-Related	-	220	900	1,195
Total Impact	20	480	1,020	1,195
Baseline	9,280	9,575	10,450	11,150
Total Impact As a Percent of Baseline	*	5%	10%	11%
Fairview Township & Borough				
Construction-Related	55	435	210	-
Operations-Related	-	205	470	530
Total Impact	55	640	680	530
Baseline	9,220	9,590	10,340	11,300
Total Impact As a Percent of Baseline	1%	7%	7%	5%
Millcreek Township				
Construction-Related	55	980	510	-
Operations-Related	-	95	270	515
Total Impact	55	1,075	780	515
Baseline	40,840	41,630	43,480	45,600
Total Impact As a Percent of Baseline	*	3%	2%	1%
Rest of Pennsylvania Principal Study Area				
Construction-Related	80	1,065	500	-
Operations-Related	-	195	525	935
Total Impact	80	1,260	1,025	935
Baseline	200,490	202,420	207,990	211,950
Total Impact As a Percent of Baseline	*	1%	1%	1%

(1) Includes Pennsylvania Local Study Area - Springfield Township and East Springfield Borough.
*Less than 0.5%.

Source: Population baseline; Construction Labor Requirements, and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-56

Total Mover Population in the Pennsylvania Principal Study Area and Key Coastal Communities -- 1979-1990

	1979	1981	1986	1990
Pennsylvania Principal Study Area (1)				
Construction-Related	210	1,790	765	-
Operations-Related	-	1,025	4,395	6,030
Total Impact	210	2,815	5,160	6,030
Baseline	263,190	266,780	276,240	284,000
Total Impact As a Percent of Baseline	*	1%	2%	2%
Girard Area				
Construction-Related	20	160	60	-
Operations-Related	-	220	900	1,195
Total Impact	20	380	960	1,195
Baseline	9,280	9,575	10,450	11,150
Total Impact As a Percent of Baseline	*	4%	9%	11%
Fairview Township & Borough				
Construction-Related	55	335	150	-
Operations-Related	-	205	470	530
Total Impact	55	540	620	530
Baseline	9,220	9,590	10,540	11,300
Total Impact As a Percent of Baseline	1%	6%	6%	5%
Millcreek Township				
Construction-Related	55	480	210	-
Operations-Related	-	95	270	515
Total Impact	55	575	480	515
Baseline	40,840	41,630	43,480	45,600
Total Impact As a Percent of Baseline	*	1%	1%	1%
Rest of Pennsylvania Principal Study Area				
Construction-Related	80	680	285	-
Operations-Related	-	195	525	960
Total Impact	80	875	810	960
Baseline	200,490	202,520	207,990	211,950
Total Impact As a Percent of Baseline	*	*	*	1%

(1) Includes Pennsylvania Local Study Area - Springfield Township and East Springfield Borough.

*Less than 0.5%.

Source: Population baseline; Construction Labor Requirements, and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-57

Total Weekly Population in the Pennsylvania Principal Study Area and Key Coastal Communities -- 1979-1990

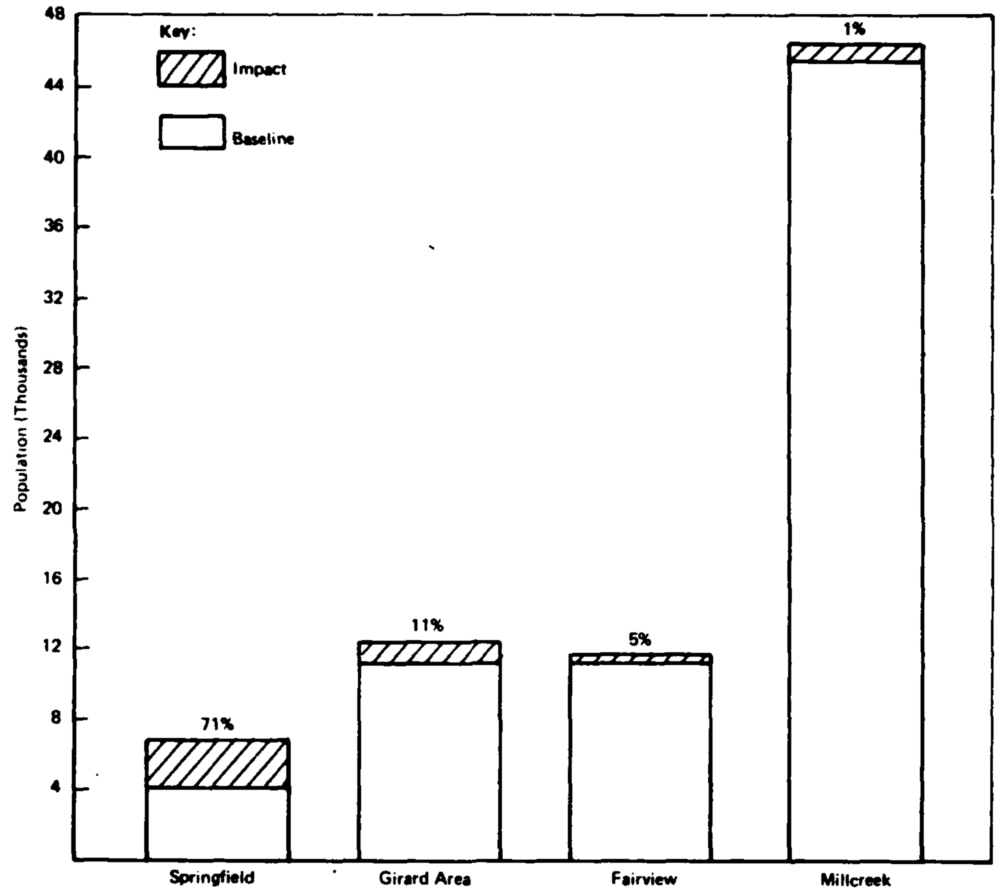
	1979	1981	1986	1990
Pennsylvania Principal Study Area[1]				
Total Impact[2]	-	1,085	635	-
Baseline	263,190	266,780	276,240	284,000
Total Impact As a Percent of Baseline	-	*	*	-
Girard Area				
Total Impact[2]	-	100	60	-
Baseline	9,280	9,575	10,450	11,150
Total Impact As a Percent of Baseline	-	1%	1%	-
Fairview Township & Borough				
Total Impact[2]	-	100	60	-
Baseline	9,220	9,590	10,540	11,300
Total Impact As a Percent of Baseline	-	1%	1%	-
Millcreek Township				
Total Impact[2]	-	500	300	-
Baseline	40,840	41,630	43,480	45,600
Total Impact As a Percent of Baseline	-	1%	1%	-
Rest of Pennsylvania Principal Impact Area				
Total Impact[2]	-	385	215	-
Baseline	200,490	202,420	207,990	211,950
Total Impact As a Percent of Baseline	-	*	*	-

(1) Includes Pennsylvania Local Study Area - Springfield Township and East Springfield Borough.

(2) All impact is construction-related.

*Less than 0.5%.

Source: Population baseline; Construction Labor Requirements and Characteristics Working Paper; SIMPACT IV Model.



Source: Population baseline; Economics and Demographics Operations Phase Working Paper; SIMPACT IV Model.

Figure 12(c) **POPULATION IMPACTS IN THE PENNSYLVANIA PRINCIPAL STUDY AREA – 1990**

b) Population Density

4.114
Development-related population increases will generate parallel impacts on population density in each of the communities of the Principal Study Area (refer to Table 4-58). The largest increase in population, and therefore the largest increase in density, is expected to occur in the Pennsylvania Local Study Area. However, even with the impact of new residents, Springfield will maintain its basically rural character, with a population density level in 1990 less than that of any other Coastal Community in 1975. Baseline and impact population densities in the Coastal Communities for 1990 are presented in Figure 4-12(d). Although density levels will increase in each community as a result of development-related new residents, there will be no significant change in the relationships among communities. None of the more rural portions of the Principal Study Area is expected to attain density levels comparable to the more urban and suburban communities (Conneaut, Ashtabula City, and Millcreek) in the area.

c) Characteristics of the New Resident Mover Population

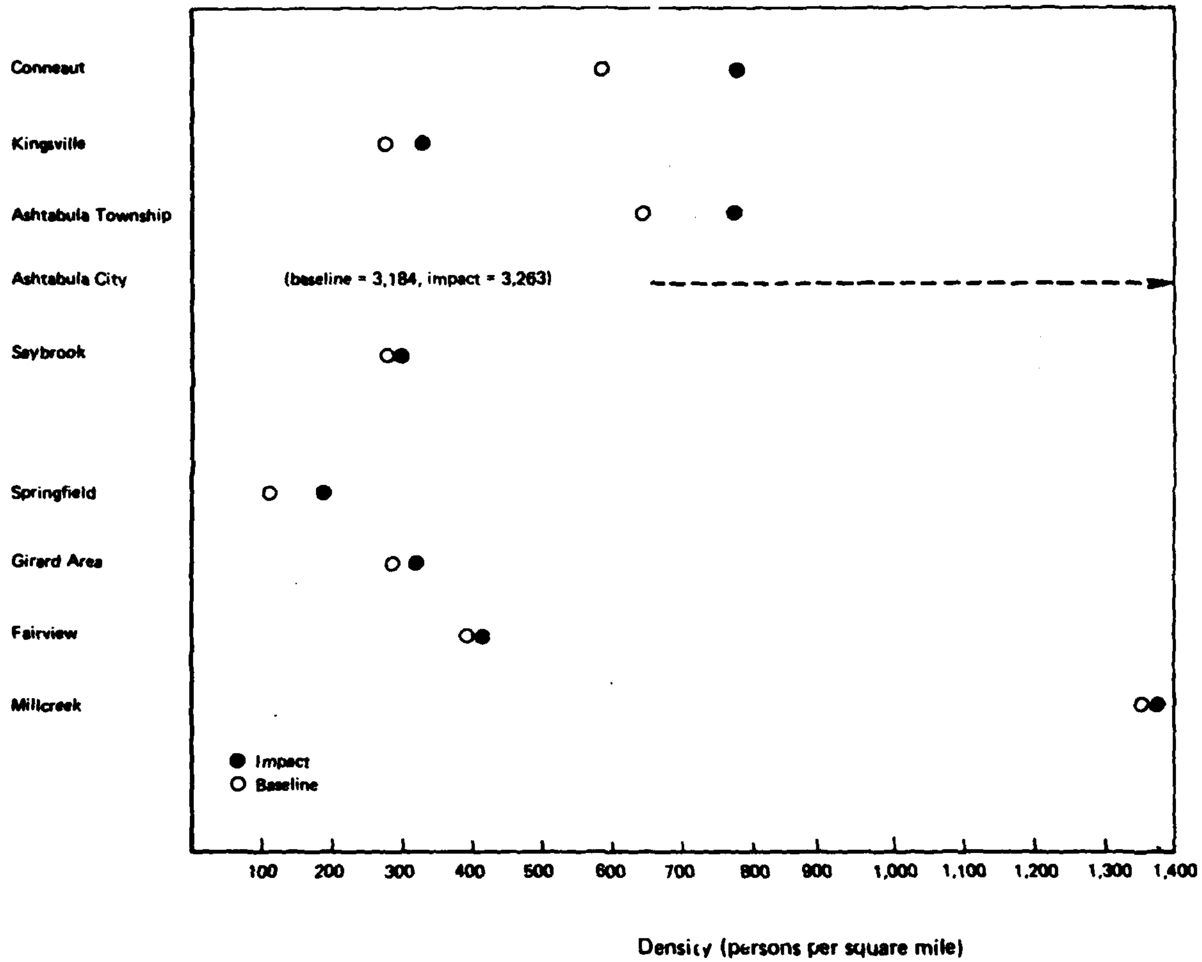
4.115
This subsection describes the household size and age distribution characteristics of the new resident mover population. Even though some 40 percent of the construction-related population impact in 1981 and 1986 is expected to be created by weekly workers, these temporary residents will, by definition, have no long-term impact on the overall structure of the population of the Regional Study Area. It is only the mover households which will create long-term population-related demands for infrastructure and services. The average size of construction-related households is expected to be 3.5 persons in 1979, with declines in later years (refer to Table 4-59). This reflects the assumption that larger households would more likely move into the area during the early years of the projection period, while smaller households would predominate in later years, when the expected length of employment at the site is less. The average size of operations-related households is expected to be 3.6 persons throughout the projection period. The average household size associated with the mover population for both construction and operations is higher than the projected baseline household size in the Principal Study Area. This reflects assumptions about the age distribution of new residents. It is expected that no new residents would be older than 65 (refer to Figure 4-12(e). However, under baseline conditions, about 10 percent of the population of the Principal Study Area would fall into this age group. Since most elderly residents live in one-or two-person households, they effectively lower the area's average household size.

Table 4-58

Population Densities in the Principal Study Area

		People Per Square Mile			
		Baseline		With Proposed Facility	
Ohio	Area (Sq Mi)	1979	1990	1979	1990
Local Study Area					
Conneaut City	27.4	547	577	548	769
Principal Study Area	369.5	205	214	206	240
Kingsville Township and Village	23.0	220	263	223	315
Ashtabula Township	13.4	585	634	585	761
Ashtabula City	6.8	3,474	3,184	3,474	3,263
Saybrook Township	31.4	231	283	231	292
Rest of Principal Study Area	267.5	64	67	64	70
Pennsylvania					
Local Study Area					
Springfield Township and East Springfield Borough	37.8	89	106	89	181
Principal Study Area	778.0	338	365	339	373
Girard Area	38.9	239	287	239	317
Fairview Township and Borough	28.6	322	395	324	414
Millcreek Township	33.7	1,212	1,353	1,213	1,368
Rest of Principal Study Area	639.0	314	332	314	333

Source: Population baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.



Source: Population baseline; Economics and Demographics Operations Phase *Working Paper; SIMPACT IV Model.*

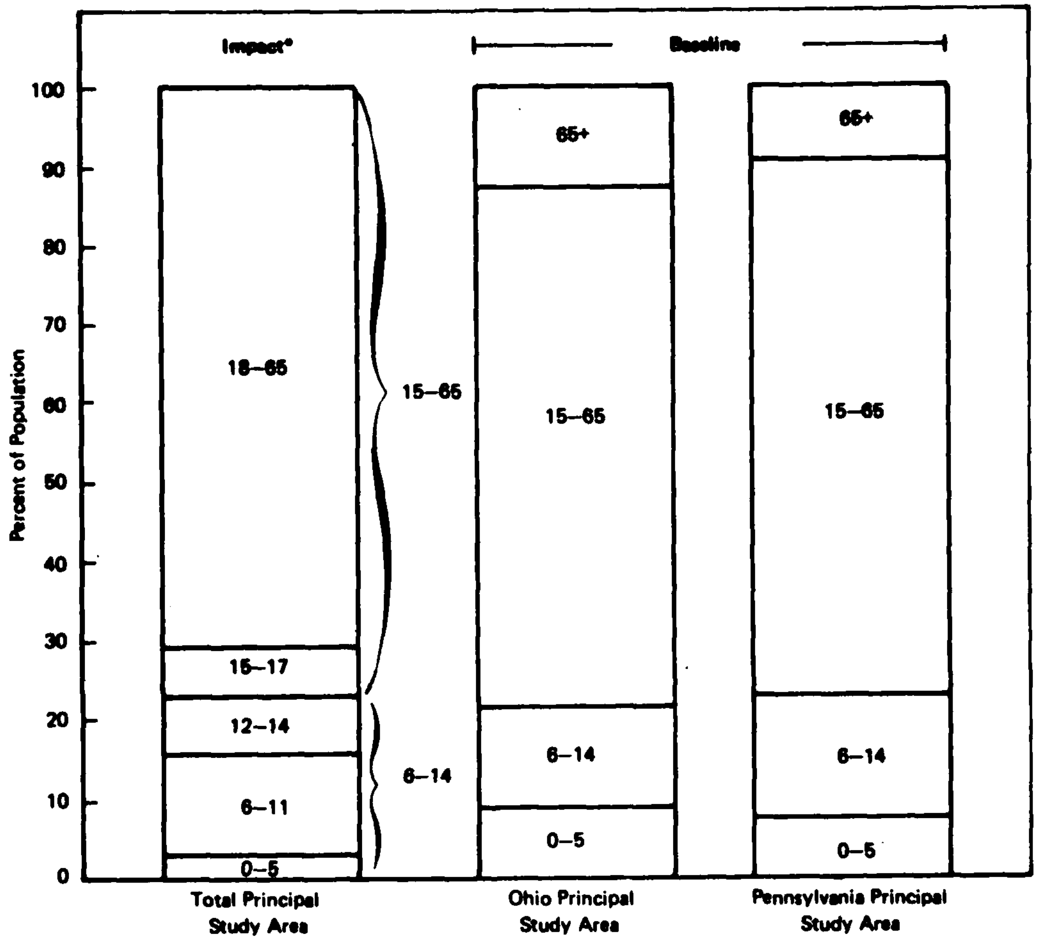
Figure 12(d) POPULATION DENSITY IN THE PRINCIPAL STUDY AREA – 1990

Table 4-59

Assumptions on Persons Per Household -- 1979-1990

	1979	1981	1986	1990
Total Principal Study Area				
Construction-Related				
Movers	3.5	3.3	3.2	--
Weeklies	1.0	1.0	1.0	--
Operations-Related	--	3.6	3.6	3.6
Baseline	3.0	2.9	2.8	2.7

Source: Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.



*Very few new residents are expected to be in the 65+ age group.

Source: Population baseline; Economics and Demographics Operations Phase Working Paper; SIMPACT IV Model.

Figure 12(e) AGE DISTRIBUTION OF THE NEW RESIDENT MOVER POPULATION IN THE PRINCIPAL STUDY AREA – 1990

4.116
The age distribution of the new population was estimated from the distribution of households by size. This distribution implies that approximately 55 percent of the new in-migrant population is comprised of either workers or individuals married to workers, given that all families are assumed to have two adults, and that single households are represented by adults. Therefore, at most, 45 percent of the new population will be under 18 years of age. This assumption is similar for both operations and construction-related new population (refer to Table 4-60). As children of new residents grow older over the course of the projection period, some of them will enter the 18-65 age group. This movement accounts for the change in this age group's share of population from 56 percent of the new residents in 1979 to 70 percent in 1990. Since the adults moving into the Principal Study Area are expected to be 25-45 years old, none of them will have reached age 65 by 1990.

d) New Resident Households

4.117
Overall, incremental increases in the number of households relative to the baseline are expected to be less than the corresponding increases in population created by movers. This is due to the larger average household size among the new resident population relative to the baseline. However, in communities with relatively large household sizes under baseline conditions (Kingsville and Millcreek), the difference between population and household impacts will be less than in communities with a relatively small baseline average household size (Conneaut and Ashtabula Township). The relationship between average household size for baseline households and the new resident population in 1990 is illustrated in Figure 4-13.

Local Study Area

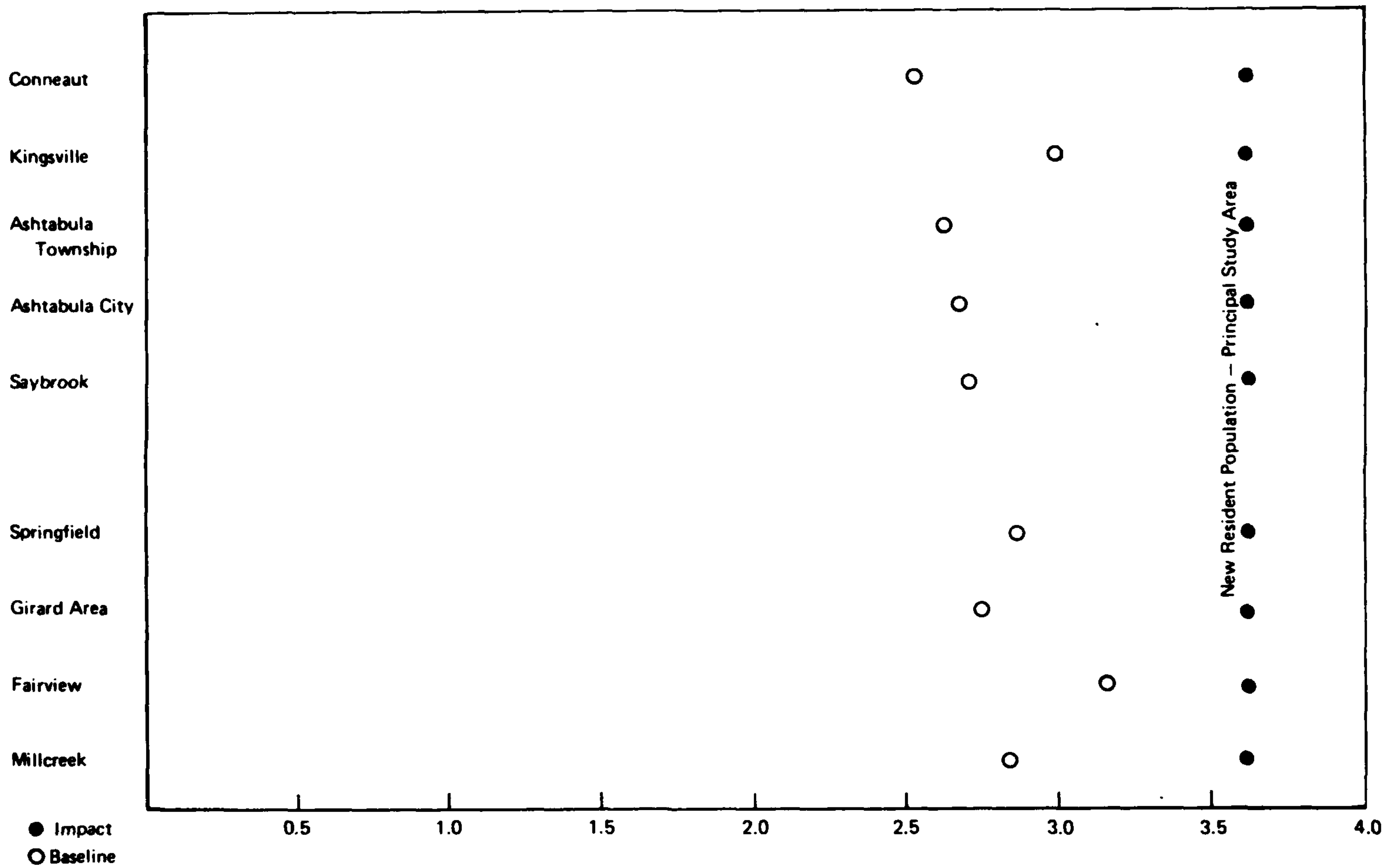
4.118
In the Ohio Local Study Area, the maximum household impact is expected to occur in 1990, when 1,450 operations-related new households are estimated to be in the city of Conneaut (refer to Table 4-61). These households are expected to average 3.63 people (vs. 2.50 people per household in the baseline forecast) and represent 23 percent of the baseline household forecast. The relatively small household size in the baseline forecast reflects the large elderly population living in Conneaut. In 1990, 14 percent of Conneaut's population is expected to be over 65 years, the highest proportion in any of the Coastal Communities within the Principal Study Area. In Springfield Township and East Springfield Borough, the largest operations-related household impact should also occur in 1990 when 780 additional households are expected in the Pennsylvania Local

Table 4-60

Age Distribution of the Mover Population -- 1979-1990
(Percent of_Total)

	1979	1981			1986			1990
	Construction-Related	Construction-Related	Operations-Related	Total	Construction-Related	Operations-Related	Total	Operations-Related
0-5	8%	6%	15%	11%	5%	10%	9%	3%
6-11	23	17	15	16	19	10	11	13
12-14	11	14	7	10	13	8	8	7
15-17	2	4	8	6	3	7	7	7
18-65	56	59	55	57	60	65	65	70
65+	0	0	0	0	0	0	0	0
Total	100%	100%	100%	100%	100%	100%	100%	100%

Source: Construction and Economic and Demographic Working Papers; SIMPACT IV Model.



Source: Population baseline; Economics and Demographics Working Paper; SIMPACT IV Model.

FIGURE 4–13 AVERAGE HOUSEHOLD SIZE IN THE COASTAL COMMUNITIES – 1990

Table 4-61

Total New Resident Mover Households in the Local Study Area -- 1979-1990

	1979	1981	1986	1990
Conneaut				
Construction-Related	5	90	40	--
Operations-Related	--	150	1,025	1,450
Total Impact	5	240	1,065	1,450
Baseline	5,510	5,690	6,110	6,320
Total Impact as a Percent of Baseline	*	4%	17%	23%
Springfield				
Construction-Related	--	40	20	--
Operations-Related	--	85	615	780
Total Impact	--	125	635	780
Baseline	1,085	1,145	1,310	1,405
Total Impact as a Percent of Baseline	--	11%	48%	55%

*Less than 0.5%.

Source: Population baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Study Area. Although the average size of these new households is assumed to be the same as in the Ohio Local Study Area, their impact is estimated to be 56 percent of the projected baseline household level in 1990.

Principal Study Area

4.119
The household impacts in the Ohio and Pennsylvania Principal Study Areas and Coastal Communities are shown in Tables 4-62 and 4-63. The trends are similar to the population impacts, as more construction-related households are expected to be located in these communities relative to operations households. In Ohio, Kingsville Township and Village and Ashtabula Township are expected to experience larger household impacts relative to the baseline than other communities. In Kingsville Township and Village, the incremental household impact is expected to amount to 16 percent of the baseline by 1990. In Ashtabula Township, the maximum impact is also expected to occur in 1990 when operations-related households should account for 14 percent of the baseline level. In the other communities of Ohio, the impact of additional households should be less than five percent of baseline. For Pennsylvania, the impact of additional households from the proposed facility and related development is expected to be less than in Ohio. In the Pennsylvania Principal Study Area and Coastal Communities, the total impact as a proportion of the baseline forecasts is less than 10 percent in each of the maximum potential impact years. Only in the Girard Area and Fairview Township and Borough do the percentages exceed five percent. In the Girard Area, the maximum impact is expected in 1990 when development-related households would account for eight percent of the baseline forecasts. Fairview Township and Borough are expected to have 100 new resident mover households in the 1981 construction phase of the proposed facility and 55 operations-related households. The total impact would equal about five percent of baseline in that year. By 1990, the portion is projected to decline to four percent of baseline since the plant construction activity will have ended by then.

Impacts on Housing

a) Housing Requirements

4.120
The analysis of probable housing impacts begins with a determination of the total demand for housing units by in-migrant workers. This demand has been estimated for all activities related to the construction and operation of the proposed Lakefront facility. The housing requirements analysis draws upon the findings and results of other parts of this impact analysis. First, the number of impact-related

Table 4-62

Total New Resident Mover Households in the Ohio Principal Study Area and Key Coastal Communities -- 1979-1990

	1979	1981	1986	1990
Ohio Principal Study Area[1]				
Construction-Related	40	435	195	-
Operations-Related	-	445	2,005	2,695
Total Impact	40	880	2,200	2,695
Baseline	26,265	27,035	28,870	29,660
Total Impact As a Percent of Baseline	*	3%	8%	9%
Kingsville Township and Village				
Construction-Related	20	110	50	-
Operations-Related	-	100	265	330
Total Impact	20	210	315	330
Baseline	1,580	1,675	1,905	2,060
Total Input As a Percent of Baseline	1%	12%	16%	16%
Ashtabula Township				
Construction-Related	-	45	20	-
Operations-Related	-	75	355	465
Total Impact	-	120	375	465
Baseline	2,770	2,875	3,130	3,270
Total Impact As a Percent of Baseline	-	4%	12%	14%
Ashtabula City				
Construction-Related	-	45	20	-
Operations-Related	-	10	100	150
Total Impact	-	55	120	150
Baseline	8,255	8,315	8,395	8,230
Total Impact As a Percent of Baseline	-	1%	1%	2%
Saybrook Township				
Construction-Related	5	50	20	-
Operations-Related	-	55	75	75
Total Impact	5	105	95	75
Baseline	2,490	2,645	3,040	3,310
Total Impact As a Percent of Baseline	*	4%	3%	2%
Rest of Ohio Principal Study Area				
Construction-Related	10	95	45	-
Operations-Related	-	55	185	225
Total Impact	10	150	230	225
Baseline	5,660	5,835	6,290	6,470
Total Impact As a Percent of Baseline	*	3%	4%	4%

[1] Includes Ohio Local Study Area - Conneaut City.

* Less than 0.05%.

Source: Population baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Table 4-63

Total New Resident Mover Households in the Pennsylvania Principal Study Area and Key Coastal Communities -- 1979-1990

	1979	1981	1986	1990
Pennsylvania Principal Study Area[(1)]				
Construction-Related	60	540	240	-
Operations-Related	-	280	1,210	1,660
Total Impact	60	820	1,450	1,660
Baseline	88,870	92,135	100,100	104,410
Total Impact As a Percent of Baseline	*	1%	1%	2%
Girard Area				
Construction-Related	5	50	20	-
Operations-Related	-	60	245	330
Total Impact	5	110	265	330
Baseline	3,135	3,310	3,785	4,100
Total Impact As a Percent of Baseline	*	3%	7%	8%
Fairview Township & Borough				
Construction-Related	15	100	50	-
Operations-Related	-	55	130	145
Total Impact	15	155	180	145
Baseline	2,695	2,865	3,295	3,585
Total Impact As a Percent of Baseline	1%	5%	5%	4%
Millcreek Township				
Construction-Related	15	145	65	-
Operations-Related	-	25	75	140
Total Impact	15	170	140	140
Baseline	13,565	14,150	15,550	16,465
Total Impact As a Percent of Baseline	*	1%	1%	1%
Rest of Pennsylvania Principal Study Area				
Construction-Related	25	205	85	-
Operations-Related	-	55	145	265
Total Impact	25	260	230	265
Baseline	68,390	70,665	76,160	78,855
Total Impact As a Percent of Baseline	-	*	*	*

(1) Includes Pennsylvania Local Study Area--Springfield Township and East Springfield Borough.

*Less than 0.05%.

Source: Population baseline; Construction Labor Requirements and Characteristics and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

workers required for each year of the study period (1979-1990) is estimated. From this total, a determination is made of the number of permanent in-migrant and temporary weekly workers. These two categories of workers are then aggregated into household groupings based upon thei, assumed income and family size characteristics. Households are then allocated to each of the Coastal Communities and remainder of the Principal Study Area, based upon assumed place-of-residence distributions. The number of households is translated into demand for various types of new housing units, existing homes, and temporary (motels, mobile homes, rooms for rent) accommodations. Housing type preferences are estimated on the basis of the distribution of households by income and size. Finally, the construction labor requirements necessary to build the new housing units are estimated.

Total Annual Demand for Housing

4.121
The total plant-related housing demand is shown in Table 4-64. Included in this table is the total demand for new housing units, existing housing units, and temporary housing units to accommodate all new in-migrant employees associated with the construction and operation of the proposed Lakefront facility and related development. This total demand is broken into demand for permanent and temporary units. The temporary units are included as a requirement for weekly construction workers. Peak and average annual housing demands have also been computed to show the fluctuation in market demand anticipated for each of the Principal Study Areas during the selected study period. These data indicate from Table 4-64 that the permanent housing demand rises for the most part throughout the study period. For example, in the Principal Study Area in 1979, there is an average demand for 96 permanent housing units. In 1980, the demand increases to 845, thus requiring an additional 750 units. By 1990, the total housing demand is projected to increase to 4,350. The differences in percentages between the annual peak and average housing demand for this component of the workforce is greatest during the initial construction phase 1979-1980. At this time, however, the level of new housing requirements is expected to be minimal. Therefore, the actual deviations in annual vs. peak demand for permanent housing is quite small and remains so throughout the study period. This fluctuation is explained in terms of the demand for temporary housing. As shown in Table 4-64, the peak demand for the temporary accommodations coincides with peak construction phases of the proposed facility (1981 and 1986). Variability in the Lakefront Plant construction effort will cause a fluctuation in employment levels, which will in turn effect housing demand month-to-month and year-to-year. The difference between peak and average temporary housing demands is projected to vary between 15-75 percent during the peak

Table 4-64

Total Peak and Average Annual Housing Unit Demand in the Local and Principal Study Areas -- 1979-1990

Local Study Area	Year	Total Housing Demand: Peak Demand	Total Housing Demand: Average Demand	Total Housing Demand: Percent Difference	Permanent Housing Demand: Peak Demand	Permanent Housing Demand: Average Demand	Permanent Housing Demand: Percent Difference	Temporary Housing Demand[1]: Peak Demand	Temporary Housing Demand[1]: Average Demand	Temporary Housing Demand[1]: Percent Difference
Conneaut	1979	50	15	70%	10	5	50%	40	10	75%
	1980	220	125	45	90	80	10	130	45	65
	1981	505	440	15	235	235	0	270	205	25
	1982	850	775	10	790	760	5	60	15	75
	1983	770	770	0	770	770	0	0	0	0
	1984	830	815	2	805	805	0	25	10	60
	1985	960	905	5	880	875	1	80	30	60
	1986	1205	1180	2	1075	1070	1	130	110	15
	1987	1430	1430	0	1425	1425	0	5	5	0
	1988	1415	1415	0	1415	1415	0	0	0	0
	1989	1435	1435	0	1435	1435	0	0	0	0
	1990	1450	1450	0	1450	1450	0	0	0	0
Springfield	1979	0	0	0	0	0	0	0	0	0
	1980	40	35	15	40	35	15	0	0	0
	1981	125	125	0	125	125	0	0	0	0
	1982	405	395	2	405	395	2	0	0	0
	1983	415	415	0	415	415	0	0	0	0
	1984	450	450	0	450	450	0	0	0	0
	1985	510	495	3	495	490	1	15	5	65
	1986	630	630	0	630	630	0	0	0	0
	1987	770	770	0	770	770	0	0	0	0
	1988	770	770	0	770	770	0	0	0	0
	1989	780	780	0	780	780	0	0	0	0
	1990	780	780	0	780	780	0	0	0	0
Total Prinicpal Study Area	1979	225	110	50	155	95	40	70	15	80
	1980	2320	1325	45	960	845	10	1360	480	65
	1981	4350	3705	15	1690	1690	0	2660	2015	25
	1982	3300	2715	15	2940	2625	10	360	90	75
	1983	2460	2460	0	2460	2460	0	0	0	0
	1984	2700	2640	2	2645	2620	1	55	20	65
	1985	4000	3395	15	3170	3085	3	830	310	65
	1986	5080	4820	5	3675	3650	1	1405	1170	15
	1987	4330	4330	0	4315	4315	0	15	15	0
	1988	4270	4270	0	4270	4270	0	0	0	0
	1989	4315	4315	0	4315	4315	0	0	0	0
	1990	4350	4350	0	4350	4350	0	0	0	0

(1) Based on the number of weekly contribution workers.

Source: New Residential Housing Requirements Working Paper; SIMPACT IV Model.

construction years of the proposed facility. The average demand figures were used as a basis for estimating new housing construction due to the risk factor involved in building homes for a temporary fluctuating market. Peak demand figures were also used to indicate the projected total amount of activity that the project could generate directly and indirectly on the housing market for both existing and newly-constructed permanent homes and for temporary accommodations.

Total Requirements for New Housing Units

4.122
From the average annual amount of housing market activity generated by the proposed project and its related activity (refer to Table 4-64) it is necessary to differentiate newly constructed housing unit demand from the demand for existing units.

Permanent Housing Units

4.123
Annual new housing requirements for the principal, and local study area, are presented in Table 4-65. To estimate the number of new housing units required on an annual basis, it is first necessary to determine the need for construction-related and operations-related households. The construction schedule for the proposed facility and its related activity indicates the likelihood of a surplus of housing units because construction-related households require permanent housing units only during the construction phases (1979-1982 and 1984-1987). In order to assess the greatest degree of impact of the proposed facility on the housing stock, construction workers are assumed to remain in the study area after completion of facility construction, so their units would not become available to additional in-migrant operations (or construction) workers. The requirement for new housing units is therefore the combination of both operations and construction-related requirements as shown in Table 4-65, columns 1 and 4. The preference for existing housing units is limited to those larger-size households having moderate incomes. However, in the Principal Study Area communities of Pennsylvania and Ohio, the vacancy rates for single-family year-round, owner-occupied housing units vary between 0.6 percent and 1.5 percent (the Bureau of the Census national average rate is 6.5 percent). Even a tight real estate market would require at least a one percent vacancy rate for the continual sale and purchase of homes. Therefore, it is assumed that there will not be a surplus of existing homes on the market for in-migrants. The number of existing housing units required during the construction and operation phases is presented in Table 4-65, columns 2 and 5, respectively. The addition of the requirements for

Table 4-65

Requirement for Permanent New Housing Units -- 1979-1990(1)

Local Study Area	Construction-Related Requirements: New Housing Units Required	Construction-Related Requirements: Existing Housing Units Required	Construction-Related Requirements: Total Housing Units Required	Operations-Related Requirements: New Housing Units Required	Operations-Related Requirements: Existing Housing Units Required	Operations-Related Requirements: Total Housing Units Required	Total Estimated Construction and Operations-Related Requirements	Composition of The Housing Requirement: Single-Family	Composition of The Housing Requirement: Multi-Family
Conneaut									
1979	5	0	5	0	0	0	5	5	0
1980	65	10	75	0	0	0	75	65	10
1981	10	0	10	110	35	145	155	115	40
1982	0	0	0	445	140	585	585	445	140
1983	0	0	0	30	10	40	40	30	10
1984	0	0	0	25	10	35	35	30	5
1985	0	0	0	30	5	35	35	25	10
1986	0	0	0	140	45	185	185	140	45
1987	0	0	0	295	95	390	390	295	95
1988	0	0	0	0	0	0	0	0	0
1989	0	0	0	15	5	20	20	20	0
1990	0	0	0	10	5	15	15	15	0
Springfield									
1979	0	0	0	0	0	0	0	0	0
1980	30	5	35	0	0	0	35	35	0
1981	5	0	5	65	20	85	90	90	0
1982	0	0	0	225	75	300	300	300	0
1983	0	0	0	25	5	30	30	30	0
1984	0	0	0	25	10	35	35	35	0
1985	0	0	0	25	5	30	30	30	0
1986	0	0	0	100	35	135	135	135	0
1987	0	0	0	120	35	155	155	155	0
1988	0	0	0	0	0	0	0	0	0
1989	0	0	0	5	5	10	10	10	0
1990	0	0	0	0	0	0	0	0	0

Table 4-65 (Continued)

	Construction-Related Requirements			Operations-Related Requirements			Total Estimated Construction and Operations-Related Requirements	Composition of The Housing Requirement	
	New Housing Units Required	Existing Housing Units Required	Total Housing Units Required	New Housing Units Required	Existing Housing Units Required	Total Housing Units Required		Single-Family	Multi-Family
Ohio Coastal Communities									
Kingsville									
1979	20	0	20	0	0	0	20	20	0
1980	70	10	80	0	0	0	80	80	0
1981	10	0	10	80	20	100	110	110	0
1982	0	0	0	70	25	95	95	95	0
1983	0	0	0	10	5	15	15	15	0
1984	0	0	0	10	0	10	10	10	0
1985	0	0	0	15	5	20	20	20	0
1986	0	0	0	15	5	20	20	20	0
1987	0	0	0	50	15	65	65	65	0
1988	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0
1990	0	0	0	5	5	10	10	10	0
Ashtabula Township									
1979	0	0	0	0	0	0	0	0	0
1980	30	5	35	0	0	0	35	35	0
1981	5	0	5	55	20	75	80	80	0
1982	0	0	0	125	35	160	160	160	0
1983	0	0	0	20	10	30	30	30	0
1984	0	0	0	20	5	25	25	25	0
1985	0	0	0	20	5	25	25	25	0
1986	0	0	0	30	10	40	40	40	0
1987	0	0	0	85	25	110	110	110	0
1988	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0
Ashtabula City									
1979	0	0	0	0	0	0	0	0	0
1980	20	15	35	0	0	0	35	30	5
1981	0	5	5	5	5	10	15	5	10
1982	0	0	0	45	45	90	90	70	20
1983	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0
1986	0	0	0	5	10	15	15	10	5
1987	0	0	0	20	25	45	45	35	10
1988	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0

Table 4-65 (Continued)

	Construction-Related Requirements: New Housing Units Required	Construction-Related Requirements: Existing Housing Units Required	Construction-Related Requirements: Total Housing Units Required	Operations-Related Requirements: New Housing Units Required	Operations-Related Requirements: Existing Housing Units Required	Operations-Related Requirements: Total Housing Units Required	Total Estimated Construction and Operations-Related Requirements	Composition of The Housing Requirement: Single-Family	Composition of The Housing Requirement: Multi-Family
Saybrook									
1979	5	0	5	0	0	0	5	5	0
1980	30	5	35	0	0	0	35	35	0
1981	10	0	10	45	15	60	70	70	0
1982	0	0	0	15	0	15	15	15	0
1983	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0
Rest of Ohio Principal Study Areas									
1979	10	0	10	0	0	0	10	10	0
1980	65	10	75	0	0	0	75	75	0
1981	10	0	10	45	15	60	70	70	0
1982	0	0	0	65	20	85	85	85	0
1983	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0
1986	0	0	0	30	10	40	40	40	0
1987	0	0	0	30	10	40	40	40	0
1988	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0
Ohio Principal Study Area									
1979	40	0	40	0	0	0	40	40	0
1980	280	55	335	0	0	0	335	320	15
1981	45	5	50	340	110	450	500	450	50
1982	0	0	0	765	265	1030	1030	870	160
1983	0	0	0	60	25	85	85	75	10
1984	0	0	0	55	15	70	70	65	5
1985	0	0	0	65	15	80	80	70	10
1986	0	0	0	220	80	300	300	250	50
1987	0	0	0	480	170	650	650	545	105
1988	0	0	0	0	0	0	0	0	0
1989	0	0	0	15	5	20	20	20	0
1990	0	0	0	15	10	25	25	25	0

Table 4-65 (Continued)

	Construction-Related Requirements			Operations-Related Requirements			Total Estimated Construction and Operations-Related Requirements	Composition of The Housing Requirement	
	New Housing Units Required	Existing Housing Units Required	Total Housing Units Required	New Housing Units Required	Existing Housing Units Required	Total Housing Units Required		Single-Family	Multi-Family
Pennsylvania Coastal Communities									
Girard									
1979	5	0	5	0	0	0	5	5	0
1980	30	5	35	0	0	0	35	35	0
1981	5	0	5	45	15	60	65	65	0
1982	0	0	0	85	25	110	110	110	0
1983	0	0	0	20	10	30	30	30	0
1984	0	0	0	20	5	25	25	25	0
1985	0	0	0	15	5	20	20	20	0
1986	0	0	0	0	0	0	0	0	0
1987	0	0	0	65	20	85	85	85	0
1988	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0
Fairview									
1979	15	0	15	0	0	0	15	15	0
1980	65	10	75	0	0	0	75	75	0
1981	10	0	10	45	10	55	65	65	0
1982	0	0	0	25	10	35	35	35	0
1983	0	0	0	0	0	0	0	0	0
1984	0	0	0	10	0	10	10	10	0
1985	0	0	0	15	10	25	25	25	0
1986	0	0	0	5	0	5	5	5	0
1987	0	0	0	10	5	10	15	15	0
1988	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0
1990	0	0	0	5	0	5	5	5	0

Table 4-65 (Continued)

	Construction-Related Requirements			Operations-Related Requirements			Total Estimated Construction and Operations-Related Requirements	Composition of The Housing Requirement	
	New Housing Units Required	Existing Housing Units Required	Total Housing Units Required	New Housing Units Required	Existing Housing Units Required	Total Housing Units Required		Single-Family	Multi-Family
Millcreek									
1979	15	5	20	0	0	0	20	15	5
1980	95	10	105	0	0	0	105	85	20
1981	20	5	25	20	5	25	50	35	15
1982	0	0	0	35	10	45	45	35	10
1983	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	5	5	5	5	0
1987	0	0	0	55	15	70	70	50	20
1988	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0
Rest of Pennsylvania Principal Study Area									
1979	20	10	30	0	0	0	30	30	0
1980	140	10	150	0	0	0	150	150	0
1981	20	5	25	40	10	50	75	75	0
1982	0	0	0	65	20	85	85	85	0
1983	0	0	0	0	0	0	0	0	0
1984	0	0	0	5	0	5	5	5	0
1985	0	0	0	0	0	0	0	0	0
1986	0	0	0	10	5	15	15	15	0
1987	0	0	0	50	10	60	60	60	0
1988	0	0	0	20	10	30	30	30	0
1989	0	0	0	10	15	25	25	25	0
1990	0	0	0	10	0	10	10	10	0
Pennsylvania Principal Study Area									
1979	55	15	70	0	0	0	70	65	5
1980	360	40	400	0	0	0	400	380	20
1981	60	10	70	215	60	275	345	330	15
1982	0	0	0	435	140	575	575	565	10
1983	0	0	0	45	15	60	60	60	0
1984	0	0	0	60	15	75	75	75	0
1985	0	0	0	55	20	75	75	75	0
1986	0	0	0	115	45	160	160	160	0
1987	0	0	0	300	85	385	385	365	20
1988	0	0	0	20	10	30	30	30	0
1989	0	0	0	15	20	35	35	35	0
1990	0	0	0	15	0	15	15	15	0

Table 4-65 (Continued)

	Construction-Related Requirements			Operations-Related Requirements				Composition of The Housing Requirement	
	New Housing Units Required	Existing Housing Units Required	Total Housing Units Required	New Housing Units Required	Existing Housing Units Required	Total Housing Units Required	Total Estimated Construction and Operations-Related Requirements	Single-Family	Multi-Family
[illegible] Principal Study Area									
1979	95	15	110	0	0	0	110	105	5
1980	640	95	735	0	0	0	735	695	40
1981	105	15	120	555	170	725	845	780	65
1982	0	0	0	1200	405	1605	1605	1435	170
1983	0	0	0	105	40	145	145	140	5
1984	0	0	0	110	30	145	145	140	5
1985	0	0	0	120	35	155	155	145	10
1986	0	0	0	335	125	460	460	410	50
1987	0	0	0	780	255	1035	1035	910	125
1988	0	0	0	20	10	30	30	30	0
1989	0	0	0	30	25	55	55	55	0
1990	0	0	0	30	10	40	40	40	0

(1) Includes direct, indirect, and induced requirements anticipated as a result of the construction- and operations-related activities associated with the Lakefront Plant.

Source: Construction Labor Requirements and Characteristics Working Paper; Economics and Demographics Operations Phase Working Paper; New Residential Housing Requirements Working Paper; SIMPACT IV Model.

new housing units and for existing housing unit replacements represents the total requirement for new permanent homes (refer to Table 4-65, column #7). This requirement for 1979-1990 (5,360) in the Principal Study Area exceeds the total demand represented in Table 4-64 (4,350), due to the representation of all construction in-migrants as permanent residents for the duration of the study period.

Temporary Housing Units

4.124
The peak and the average number of construction-related workers requiring temporary accommodations is indicated in Table 4-64. The determination of the requirement for new temporary housing units was made by comparing the yearly demand for the peak (the worst case scenario) number of household units (each weekly construction worker constitutes one household) to the existing available accommodations in each community (refer to Table 4-66). Estimates of available temporary accommodations were made from a survey of the Coastal Communities. A percentage of these units was assumed to be retained for the customary year-round and transient clientele. In each community and in each year, there would be a surplus of the preferred temporary accommodations even during the peak construction periods. For the peak construction years, 1981 and 1986, the surplus temporary accommodations available in the Coastal Communities are 3,265 and 4,135, respectively. Accordingly, there would be no requirement for new motel units, mobile home spaces, or rooming house situations.

Construction Requirements to Build New Housing Units

4.125
Residential construction labor requirements are projected to precede by one-year, peak residential requirements, if housing units are to be available and in-place when demanded. The demand for housing increases during the peak construction years for the Lakefront facility reaching a peak in 1982 and 1987 as shown in Table 4-65. An estimate of the number of man-years of construction labor required to meet the peak residential requirements is shown in Table 4-67. Peak construction labor requirements for the Principal Study Area are estimated to be 1,380 man-years for 1982 construction and 930 man-years for 1987 construction compared to the 100 man-years required in 1979.

b) Impact on the Character of the Baseline Housing Stock

Growth of the Existing Housing Stock

4.126
If the proposed Lakefront Plant is built additional new housing (due to the in-migration of construction and operations workers directly

Table 4-66

Demand for Temporary Housing Accommodations in the Ohio and Pennsylvania Coastal Communities -- 1979-1990[1]

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Local Study Area												
Conneaut												
Number of Accommodations Required	40	130	270	60	0	25	80	130	5	0	0	0
Number of Accommodations Available	835	835	835	835	835	835	835	835	835	835	835	835
Number of Surplus Accommodations	795	705	565	775	835	810	755	705	830	835	835	835
Springfield												
Number of Accommodations Required	0	0	0	0	0	0	15	0	0	0	0	0
Number of Accommodations Available	110	110	110	110	110	110	110	110	110	110	110	110
Number of Surplus Accommodations	110	110	110	110	110	110	95	110	110	110	110	110
Ohio Coastal Communities												
Kingsville												
Number of Accommodations Required	5	70	135	20	0	5	50	75	5	0	0	0
Number of Accommodations Available	135	135	135	135	135	135	135	135	135	135	135	135
Number of Surplus Accommodations	130	65	0	115	135	130	85	60	130	135	135	135
Ashtabula Township												
Number of Accommodations Required	0	65	130	20	0	0	45	70	0	0	0	0
Number of Accommodations Available	405	405	405	405	405	405	405	405	405	405	405	405
Number of Surplus Accommodations	405	340	275	385	405	405	360	335	405	405	405	405
Ashtabula City												
Number of Accommodations Required	5	135	265	35	0	0	85	135	0	0	0	0
Number of Accommodations Available	745	745	745	745	745	745	745	745	745	745	745	745
Number of Surplus Accommodations	740	610	480	710	745	745	660	610	740	745	745	745
Saybrook												
Number of Accommodations Required	0	65	130	20	0	0	45	70	0	0	0	0
Number of Accommodations Available	235	235	235	235	235	235	235	235	235	235	235	235
Number of Surplus Accommodations	235	170	105	215	235	235	190	165	235	235	235	235
Pennsylvania Coastal Communities												
Girard												
Number of Accommodations Required	0	65	130	20	0	0	45	70	0	0	0	0
Number of Accommodations Available	300	300	300	300	300	300	300	300	300	300	300	300
Number of Surplus Accommodations	300	235	170	280	300	300	255	230	300	300	300	300
Fairview												
Number of Accommodations Required	0	65	130	20	0	0	50	75	0	0	0	0
Number of Accommodations Available	355	355	355	355	355	355	355	355	355	355	355	355
Number of Surplus Accommodations	355	290	225	335	355	355	305	280	355	355	355	355
Millcreek												
Number of Accommodations Required	10	330	655	90	0	10	215	350	5	0	0	0
Number of Accommodations Available	1990	1990	1990	1990	1990	1990	1990	1990	1990	1990	1990	1990
Number of Surplus Accommodations	1980	1660	1335	1900	1990	1980	1775	1640	1980	1990	1990	1990
Total Coastal Communities												
Number of Accommodations Required	60	925	1845	285	0	40	630	975	15	0	0	0
Number of Accommodations Available	5110	5110	5110	5110	5110	5110	5110	5110	5110	5110	5110	5110
Number of Surplus Accommodations	5050	4185	3265	4825	5110	5070	4480	4135	5050	5110	5110	5110
Rest of Ohio and Pennsylvania Principal Study Area												
Number of Accommodations Required[2]	10	435	815	75	0	15	200	430	0	0	0	0

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(1) Based upon peak demand.

(2) Estimates were not made for available temporary accommodations in the remaining areas of the Ohio and Pennsylvania Principal Study Areas. It is assumed that the large surplus of available accommodations found in the Coastal Communities would also be found in the surrounding areas.

Source: New Residential Housing Requirements Working Paper; Construction Labor Requirements and Characteristics Working Paper; SIMPACT IV Model.

Table 4-67

Residential Construction Labor Requirements in the Local Study Area -- 1979-1990

	Number of Units Required	Construction Labor Requirements (Man-Years)
1979		
Local Study Area		
Conneaut	5	5
Springfield	0	0
Ohio Principal Study Area	40	35
Pennsylvania Principal Study Area	70	65
Total Principal Study Area	110	100
1982 (1)		
Local Study Area		
Conneaut	585	470
Springfield	300	270
Ohio Principal Study Area	1030	860
Pennsylvania Principal Study Area	575	520
Total Principal Study Area	1605	1380
1987 (1)		
Local Study Area		
Conneaut	390	310
Springfield	155	140
Ohio Principal Study Area	650	585
Pennsylvania Principal Study Area	385	345
Total Principal Study Area	1035	930
1990		
Local Study Area		
Conneaut	15	15
Springfield	0	0
Ohio Principal Study Area	25	20
Pennsylvania Principal Study Area	15	15
Total Principal Study Area	40	35

(1) In actuality, the construction labor requirement must be on-going one year preceding the peak residential requirement 1981 and 1986.

Source: New Residential Housing Requirements Working Paper; SIMPACT IV Model.

associated with the plant or indirectly associated with the secondary activities) can be expected (refer to Table 4-65). Estimates of the potential growth effects which the impact requirements could have upon the baseline stock in the study area communities are presented in Table 4-66. The data indicate that for the Principal Study Area the plant-related impact on housing would increase the rate of growth of the baseline stock by 30 percent. The majority of this growth is expected to occur over several relatively short-time spans throughout the 12-year study period (refer to Figure 4-14). This growth rate would be spread unevenly among the study area communities.

Local Study Area

4.127
Under baseline conditions, the housing stock is projected to increase by approximately 15 percent in Conneaut and 30 percent in Springfield over the 1979-1990 period. The impact requirement is projected to increase the rates of that growth by 190 percent in Conneaut and by 245 percent in Springfield, which is an increase of 25 percent and 75 percent over the baseline growth (refer to Table 4-68). The baseline and impact housing requirements in the Local Study Area for the study period 1979-1990 are shown in Figure 4-15. The gradual steady decline in baseline housing units contrasts with the fluctuating impact requirements. New baseline housing requirements show a gradual decrease from 95 to 50 units per year in Conneaut and from 40 to 25 units per year in Springfield. The plant-related increment in the housing stock during the same timeframe reflects a greater fluctuation in demand for both communities (refer to Figure 4-15).

Ohio Principal Study Area

4.128
Plant-related housing requirements in the Ohio Principal Study Area are estimated to equal about 90 percent of the projected baseline housing unit requirements. Two Coastal Communities in Ohio, Kingsville and Ashtabula Townships, have baseline housing requirements which are similar to Conneaut's. Saybrook's requirements are greater, ranging from 70 new units in 1979 to 65 units in 1990. Ashtabula City shows a declining housing requirement and a declining housing stock. Plant-related requirements would equal about 100 percent of baseline needs in Ashtabula Township, 95 percent in Kingsville, and 15 percent in Saybrook, changing the percentage increase over 1979 baseline stock in Ashtabula Township from 15 percent to 35 percent, in Kingsville from 30 percent to 55 percent, and in Saybrook from 30 percent to 35 percent. In Ashtabula City, a negative growth would be reversed to a slight positive growth of two percent. The remainder of the Ohio Principal Study Area is expected to have impact housing requirements that equal about 35 percent of baseline requirements.

Table 4-68

Effect of Lakefront Plant Impact on the Growth of the Housing Stock--1979-1990

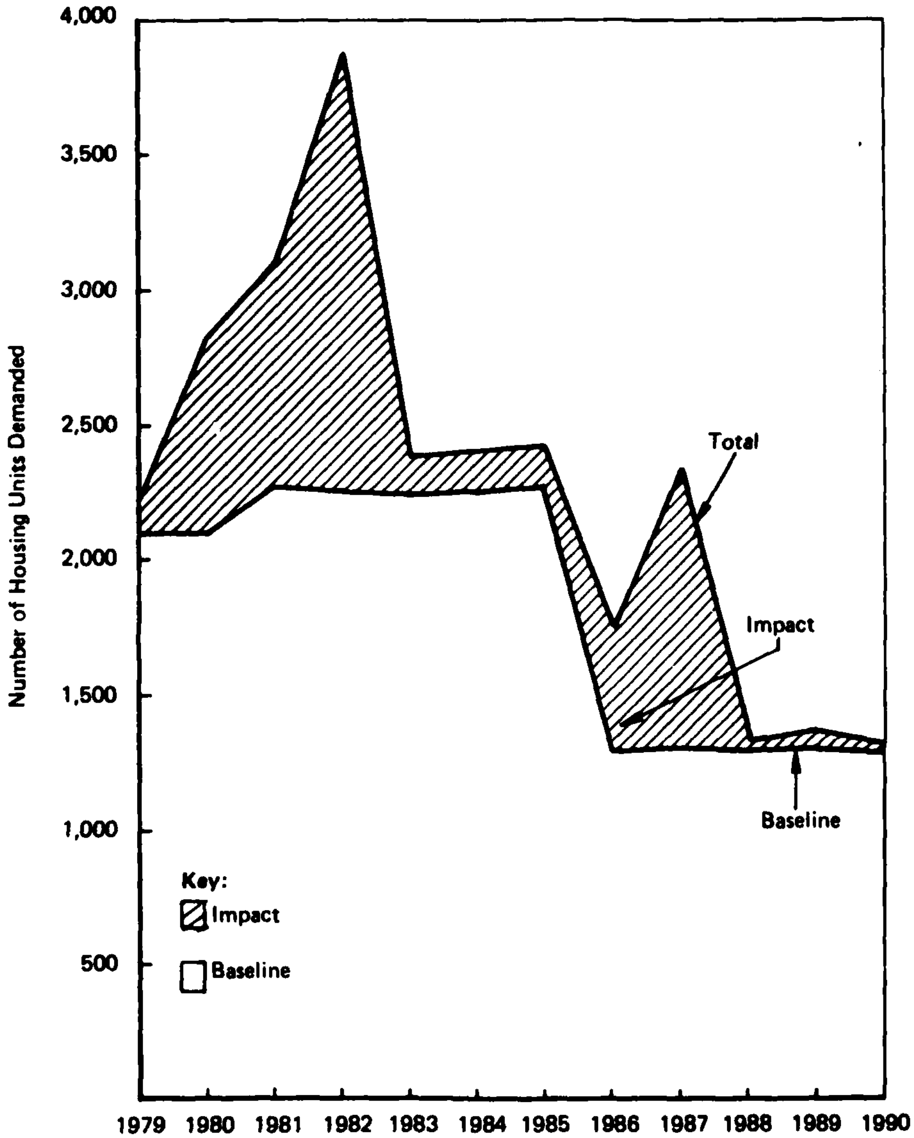
Local Study Area	Baseline Stock (1979)	Baseline[1] Requirement (1979-1990)	Baseline Stock (1990)	Impact Requirement (1979-1990)	Total Stock (1990)	% Impact Relative To Baseline Requirement	Total Growth in Stock	Projected Baseline Growth	Growth Due to Impact Requirement	Total Impact as a % of Baseline (1990)
Conneaut	5,925	820	6,745	1,540	8,285	190%	40%	15%	25%	25%
Springfield	1,110	335	1,445	820	2,265	245	105	30	75	55
Ohio Coastal Communities										
Kingsville	1,640	475	2,115	445	2,560	95	55	30	25	20
Ashtabula Township	2,825	510	3,325	505	3,830	100	35	15	20	15
Ashtabula City	8,590	175[2]	8,565[2]	200	8,765	115	2	(2)	2	2
Saybrook	2,865	820	3,685	125	3,810	15	35	30	5	3
Rest of Ohio Principal Study Area	5,565	895	6,460	320	6,780	35	20	15	5	5
Ohio Principal Study Area	27,410	3,485	30,895	3,135	34,030	90	25	15	10	10
Pennsylvania Coastal Communities										
Girard	3,215	995	4,210	375	4,585	40	45	30	15	9
Fairview	2,850	905	3,755	250	4,005	30	40	30	10	7
Millcreek	14,070	2,875	16,945	295	17,240	10	25	20	5	2
Rest of Pennsylvania Principal Study Area	71,730	10,625	82,355	485	82,840	5	15	15	0[3]	1
Pennsylvania Principal Study Area	92,975	15,735	108,710	2,225	110,935	15	20	15	5	2
Total Principal Study Area	120,385	19,220	139,605	5,360	144,965	30	20	15	5	4

(1) The baseline requirement is the sum of the increased demands for each type of housing (single-family, multi-family, and mobile home).

(2) Ashtabula City is expected to experience a declining baseline housing stock, but a change in housing mix.

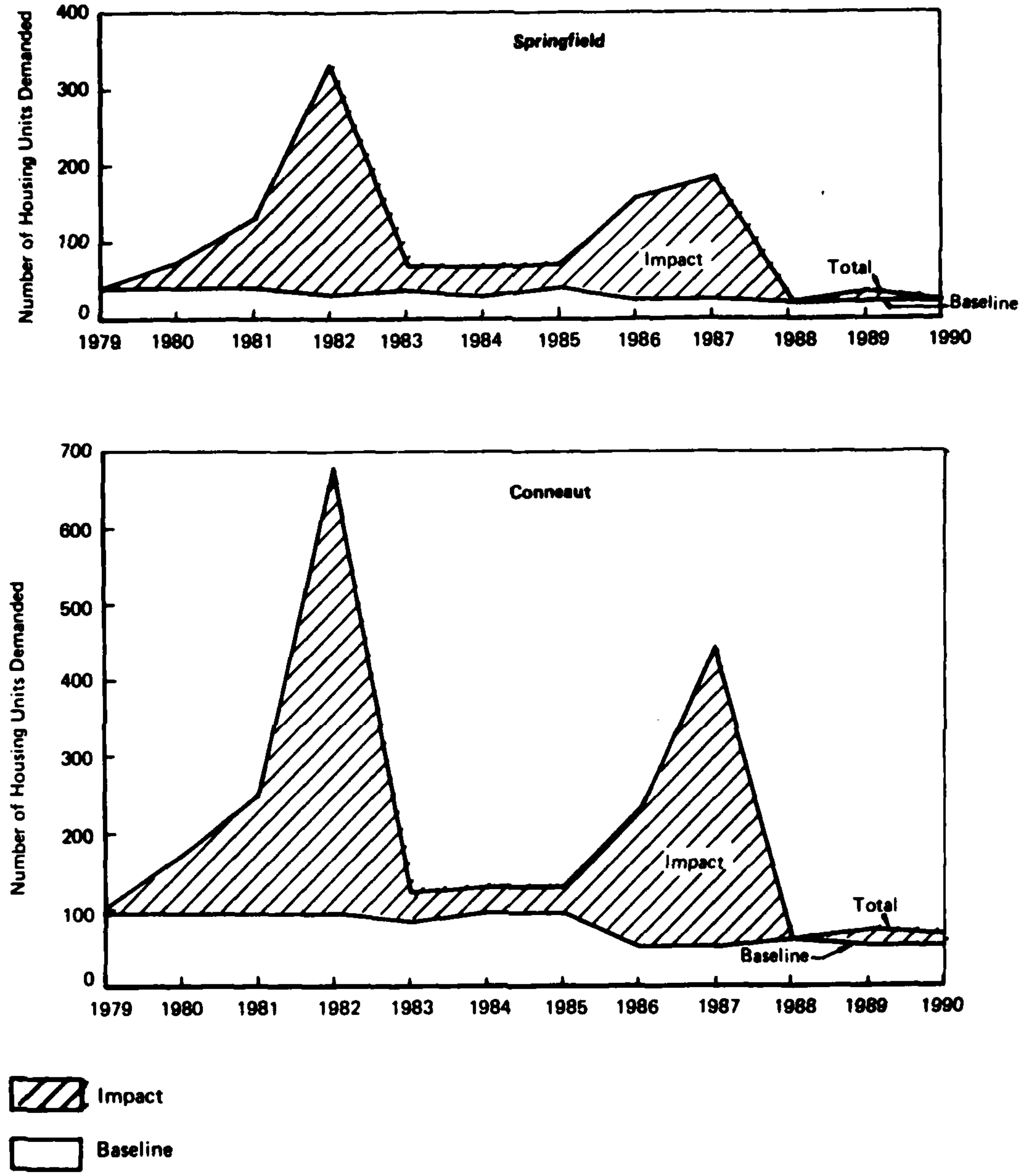
(3) Note: Less than 0.5% is rounded to 0% - numbers may not add due to rounding.

Source: Housing baseline, Regional Economics and Demographics Operations Phase Working Paper; New Residential Housing Requirements Working Paper; SIMPACT IV Model.



Source: Housing baseline; New Residential Housing Requirements Working Paper; SIMPACT IV Model.

FIGURE 4–14 COMPARISON OF BASELINE AND PLANT-RELATED HOUSING UNIT REQUIREMENTS IN THE PRINCIPAL STUDY AREA



Source: Housing baseline; New Residential Housing Requirements Working Paper; *SIMPACT IV Model.*

FIGURE 4–15 COMPARISON OF BASELINE AND PLANT-RELATED HOUSING UNIT REQUIREMENTS IN THE LOCAL STUDY AREA

Pennsylvania Principal Study Area

4.129
The growth of the housing stock in the Pennsylvania Principal Study Area would be less affected by the direct and secondary impact housing requirements associated with the Lakefront Plant than the comparable Ohio Principal Study Area. Plant-related housing requirements in this study area are estimated to equal about 15 percent of the projected baseline housing needs. Within the Pennsylvania Principal Study Area several of the Coastal Communities will probably be more heavily impacted than others. The ratio of impact to baseline housing requirements ranges from 40 percent in Girard to 10 percent in Millcreek. The remaining communities in the Pennsylvania Principal Study Area are expected to increase their housing stock minimally due to the proposed plant (refer to Table 4-68).

Composition and Occupancy Characteristics

4.130
The existing housing stock in the Principal Study Area at the inception of the construction phase of the proposed Lakefront facility is projected to be characterized by a predominance of owner-occupied single-family housing units and a low vacancy rate for unoccupied units for sale or for rent. Housing requirements related to the proposed facility are expected to have a relatively insignificant effect on the proportionate composition and occupancy characteristics projected for the baseline permanent stock in both the Ohio and Pennsylvania Principal Study Areas. The degree of change the proposed plant will impose on the composition of the housing stock for the coastal communities of the Principal Study Area (1979-1990) is shown in Table 4-69. Based on the ownership patterns for the existing permanent housing stock, it is assumed in this analysis that all single-family (detached and attached townhouses) units required by permanent construction-related or operations-related workers will be owner-occupied. All multi-family dwelling units will be renter-occupied.

Permanent Requirements

4.131
Local Study Area: The differences in composition of the projected baseline and plant-induced housing stocks for Conneaut and Springfield directly affect the multi-family and single family occupancy characteristics. In Conneaut, renter-occupied multi-facility units are expected to increase from 17 percent to 18 percent of the housing stock by 1990 under baseline conditions (refer to Table 4-69). Single-family units are expected to decrease three percentage points. The result of the projected impact on the baseline growth of

Table 4-69

Impact on the Composition of the Housing Stock

	Baseline Housing Composition 1979		Baseline Housing Composition 1990		Effect of Impact on Housing Composition	
	Baseline Stock	% Composition	Baseline Stock	% Composition	Total Housing Stock (1990) (Includes Impact Requirement)	Composition
Local Study Area						
Conneaut						
Single-Family	4,670	79%	5,130	76%	6,315	76
Multi-Family	995	17	1,185	18	1,550	19
Mobile Homes	260	4	430	6	430	5
Springfield						
Single-Family	895	80	1,160	80	1,980	87
Multi-Family	75	7	105	7	105	5
Mobile Homes	140	13	180	13	180	8
Ohio Coastal Communities						
Kingsville						
Single-Family	1,635	88	1,860	88	2,105	90
Multi-Family	135	8	185	9	185	7
Mobile Homes	70	12	70	3	70	3
Ashtabula Township						
Single-Family	2,325	82	2,785	84	3,290	86
Multi-Family	170	6	220	6	220	6
Mobile Homes	330	12	320	10	320	8
Ashtabula City						
Single-Family	6,095	71	5,925	70	6,075	69
Multi-Family	2,240	26	2,210	26	2,260	26
Mobile Homes	255	3	430	4	430	5
Saybrook						
Single-Family	2,570	90	3,265	89	3,390	89
Multi-Family	170	6	245	6	265	6
Mobile Homes	125	4	175	5	175	5
Rest of Ohio Principal Study Area						
Single-Family	4,720	85	5,410	84	5,730	85
Multi-Family	490	9	565	9	565	8
Mobile Homes	355	6	485	7	485	7
Ohio Principal Study Area						
Single-Family	21,815	80	24,375	79	27,105	80
Multi-Family	4,200	15	4,610	15	5,015	15
Mobile Homes	1,395	5	1,910	6	1,910	5
Pennsylvania Coastal Communities						
Girard						
Single-Family	2,445	76	3,160	75	3,535	77
Multi-Family	380	12	510	12	510	11
Mobile Homes	390	12	540	13	540	12
Fairview						
Single-Family	2,630	92	3,440	92	3,600	92
Multi-Family	155	5	245	6	245	6
Mobile Homes	65	3	70	2	70	2
Millcreek						
Single-Family	11,280	80	13,035	77	13,260	77
Multi-Family	1,765	12	2,325	14	2,395	14
Mobile Homes	1,045	8	1,585	9	1,585	9

Table 4-69 (Continued)

	Baseline Housing Composition 1979		Baseline Housing Composition 1990		Effect of Impact on Housing Composition	
	Baseline Stock	% Composition	Baseline Stock	% Composition	Total Housing Stock (1990) (Includes Impact Requirement)	% Composition
Rest of Pennsylvania Principal Study Area						
Single-Family	48,110	67	54,915	67	55,400	67
Multi-Family	21,640	30	24,560	30	24,560	30
Mobile Homes	1,980	3	2,880	3	2,880	3
Pennsylvania Principal Study Area						
Single-Family	65,360	70	75,710	70	77,865	70
Multi-Family	23,995	26	27,745	25	27,815	25
Mobile Homes	3,620	4	5,255	5	5,255	5
Total Principal Study Area						
Single-Family	87,175	72	100,085	72	104,970	72
Multi-Family	28,195	23	32,355	23	32,830	23
Mobile Homes	5,015	5	7,165	5	7,165	5

Note: The proportion of mobile home units increases relative to other housing types due to a decrease in the housing stock of single-family and multi-family units.

Source: Housing baseline; New Residential Housing Requirements Working Paper; SIMPACT IV Model.

the housing stock is expected to create a further increase in the number of multi-family units one percentage point relative to mobile homes which will decline by one percent. In Springfield, a more substantial change in the composition of the housing stock is expected. Here the baseline projections for the housing stock between 1979 and 1990 indicate a constant proportionate mix of housing types (80 percent single-family, seven percent multi-family, and 13 percent mobile homes). The demand for housing created by the proposed facility and its related activity should increase the proportion of single-family homes already found in Springfield as follows: seven percentage point increase in the number of single-family homes (to 87 percent), a three percentage point decrease in the number of multi-family units (to five percent) and a five percentage point decrease in the number of mobile home units (to eight percent) (refer to Table 4-69). The plant-related impact requirements indicate a shift towards a more homogeneous and more permanent housing stock associated with an increase in owner-occupied single-family homes in Springfield. The trend towards low density suburbanization would be accelerated. In Conneaut, on the other hand, the projected increase in renter-occupied multi-family units would indicate a slightly increased urbanization of that city. However, the U.S. Steel and related households may represent a slightly more sophisticated housing market for higher income and more urban-oriented families. Therefore, the projected future trend for single-family units includes attached townhouses as well as detached single-family units on varying lot sizes, and future multi-family units include low-rise as well as garden apartments. These housing types are predicted to be built in the area under baseline conditions. However, the projected plant-related rate of growth may consequently accelerate the diversity of the housing stock, while the proportional mix of single-family, multi-family, and mobile home units and the associated occupancy patterns will remain relatively constant.

4.132

Ohio Principal Study Area. The composition of the housing stock for the Ohio Principal Study Area is projected to show a baseline change of a one percentage point increase in single-family homes and a one percentage point decrease in mobile homes. The influence of the proposed plant on the general composition of housing types in the specific Coastal Communities and in the remainder of the Principal Study Area is expected to be insignificant. Of the remaining Coastal Communities in the Ohio Principal Study Area, Kingsville, Ashtabula Township, and Saybrook typically contain a predominance of owner-occupied units similar to the proportion found in Springfield. Baseline projections for Kingsville indicate a relative increase in multi-family units. The plant-related impact requirements could slightly reverse that trend creating a small decrease in the proportionate multi-family units and an increase in single-family units.

In Ashtabula Township, the trend for single-family units to increase relative to mobile home units may accelerate slightly, due to the requirements imposed by the proposed facility. Saybrook is projected to retain a stable housing type composition. These towns have a slightly larger initial housing stock than Springfield, so the projected impact housing requirements in relative terms are much lower (refer to Table 4-68). Consequently, the impact requirement will probably have less influence on the trend in occupancy patterns in these areas. Ashtabula City, with the highest proportion of renter-occupied multi-family units, may show a slight proportionate change towards fewer single-family units than projected in the baseline.

4.133
Pennsylvania Principal Study Area. The growth of the housing stock in the Pennsylvania Principal Study Area will be insignificant as a result of the proposed development. Consequently, occupancy patterns and composition of the housing stock will probably remain unaffected. In the Pennsylvania Coastal Communities, Fairview has the highest proportion (92 percent) of owner-occupied single-family housing units (similar to Saybrook and Ashtabula Township). Girard and Millcreek have a slightly greater mix of renter-occupied units, but they too are predominantly comprised of single-family units, 76 percent and 80 percent, respectively. Girard is anticipated to be the only Coastal Community with a change in housing mix resulting from the proposed facility. The proportion of single-family units projected for that community may increase two percentage points in relation to the baseline stock. Multi-family units and mobile home units are expected to both decrease by one percentage point. In all of these communities, the impact requirements are not expected to affect the proportionate composition and occupancy characteristics. These communities are slightly more populous and the plant-related housing requirements are, therefore, proportionately less than in Ohio (refer to Table 4-68). Growth of the housing stock in the Coastal Communities, due to the plant-related requirement for new housing in the Ohio and Pennsylvania Principal Study Areas, may accelerate a diversification of specific housing types. However, little change in the proportionate composition of single-family, multi-family, and mobile home units is expected. The growth in the area communities would follow existing trends toward suburbanization or urbanization at a slightly increased pace due to the influence of the impact-related requirements (refer to Tables 4-68 and 4-69).

Temporary Requirements

4.134
The temporary housing requirement is expected to create an increase in the proportion of renter-occupied units during the peak Lakefront construction years 1980-1981 and 1985-1986. However, this demand for

temporary units will mainly be supplied by the current motel accommodations and expansion potential of mobile home parks (refer to Table 4-69). This temporary demand will probably subside once the construction activity terminates (1987). In Conneaut, it is estimated that approximately 300 single-family homes may be converted so that one or more rooms may be rented. Also, some of the temporary construction workers may create a demand for rental units which mobile park owners throughout the Principal Study Area might supply. In both of these instances, the stock of temporary rental units would be further increased. However, the overall occupancy characteristics associated with the permanent housing stock will probably remain relatively unaffected.

Vacancy Rates

4.135
The vacancy rates for the permanent housing stock are assumed to remain constant at their existing low rates. These vacancy rates reflect those units which are required for the normal real estate market turnover. With an increased stock, the actual number of vacant units (units for sale or for rent) will be greater. On the other hand, the demand exerted by weekly construction workers for existing temporary housing accommodations is expected to cause the vacancy rate for that portion of the housing stock to fluctuate (refer to Table 4-64).

Age and Condition of the Housing Stock

4.136
In an area where the growth rate has been traditionally slow, the additional number of new housing units would not greatly alter the age and condition composition of the housing stock, but the newly constructed units would replace the sub-standard units at a slightly greater rate. Conversely, a substantially increased rate of growth would lower the average age and improve the overall condition of the housing stock. This assumption is based on the ability of communities to enforce quality construction and subdivision controls at a rate equal to the new construction. Additionally, the higher income level of new residents demanding existing homes or the improved incomes of current residents obtaining new jobs as a result of the plant or associated activities is likely to result in further improvements in the existing housing stock. The impact of the increased growth in the housing stock due to the activity associated with the proposed U.S. Steel facility would most likely result in lowering the average age of the housing stock and, thereby, improving the average condition of housing in the affected communities.

The Local Study Area

4.137
In Conneaut and Springfield, the housing stock is expected to grow by 25 percent and 75 percent, respectively, over the 1979-1990 period due to the proposed plant. Historically, new additions to the housing stock in these towns have been minimal. Growth in new permanent housing units at these rates, added to the baseline housing increment, would substantially lower the average age of the housing stock in both communities. Demand for temporary housing in Conneaut will probably be substantial enough to induce owners of older homes to convert them into rooming accommodations (300 units). The temporary nature of the tenancy associated with this activity and the slightly higher household density which results could have a serious overall impact on the condition of homes if not properly maintained. However, the growth in new homes due to the impact requirement (1,540 units) should outweigh any detrimental effect which this conversion activity might produce. In Springfield, the housing stock may more than double over the time span of this impact assessment. The average age will be lowered and, therefore, the overall condition of the housing stock should be improved.

The Ohio and Pennsylvania Principal Study Area

4.138
The relative extent of the effect on the age and condition of the housing stock due to the influence of the impact requirements will most likely be similar to the impact growth rates in the Principal Study Area communities. Therefore, the Ohio Coastal Communities will probably experience a slightly greater improvement in the condition of their housing stock than the Pennsylvania Coastal Communities (refer to Table 4-68). The condition of the housing stock of the outlying communities of the Principal Study Area is expected to remain substantially as expected under baseline conditions.

Low Income Public Housing

4.139
A demand for low-income housing in the Coastal Communities exists particularly in the more urbanized areas such as Conneaut and Ashtabula City in Ohio. Presently, Conneaut has one low-income housing project and Ashtabula has four. In the Pennsylvania Study Area, the city of Erie has the only available public housing. Overall, the demand for these units originates primarily in the elderly sector of the population.

The need for temporary or permanent housing associated with the proposed plant is not expected to directly affect the demand for low-income housing. However, if rents in the area were to increase, the

demand for public housing units could become more urgent, particularly for elderly households on fixed incomes.

c) Impacts on Housing Market Activity

4.140
The effect of the proposed plant on the housing market activity in the Principal Study Area is assessed in terms of the ability of the residential construction industry and the specific community planning and infrastructure framework to build the required number of new housing units in the timeframe required. The manner in which the Study Area communities accomplish this task and the degree and timing of the market activity generated by the impact housing demand will determine market and rental values.

The Ability of the Market to Meet Demand

Labor Requirements of New Construction Activity

4.141
Assuming mobility of the residential construction work force, the labor requirements are assessed in terms of the total Principal Study Area. The issues discussed are not only the supply of labor for residential construction, but the logistics of organizing that labor in an orderly manner to meet peak housing demands resulting from the activity spurred by the proposed facility. The additional labor required to construct new residences resulting from the Lakefront Plant and related activity is projected to rise from a level of only 100 man-years in 1979 to a peak of 1,380 man-years in 1981, the year of the initial peak in steel plant construction activity. This figure represents 45 percent of total residential construction activity in that year. By 1986, the year of the second peak in plant construction activity, impact labor requirements are projected to fall to a level of 930 man-years, but would still equal about 50 percent of the total residential construction. The proportion remains the same resulting from the more rapid decline in baseline requirements. Thereafter, baseline construction labor requirements remain stable, while the additional impact requirements decline further to only 40 man-years by 1990. These trends, together with the distribution of requirements in the Local Study Area and the Principal Study Area, are shown in Table 4-70 and Figure 4-16. From these data, it is apparent that labor requirements will continue to rise well into the projection period for the two Local Study Area communities while a peak will be reached in 1981 for the remainder of the Principal Study Area. The year-by-year comparison of baseline and impact requirements is shown in Figure 4-16. This graph and the data contained in Table 4-55 show that the impact housing requirement increases the construction labor requirement from 1,670 manyears to

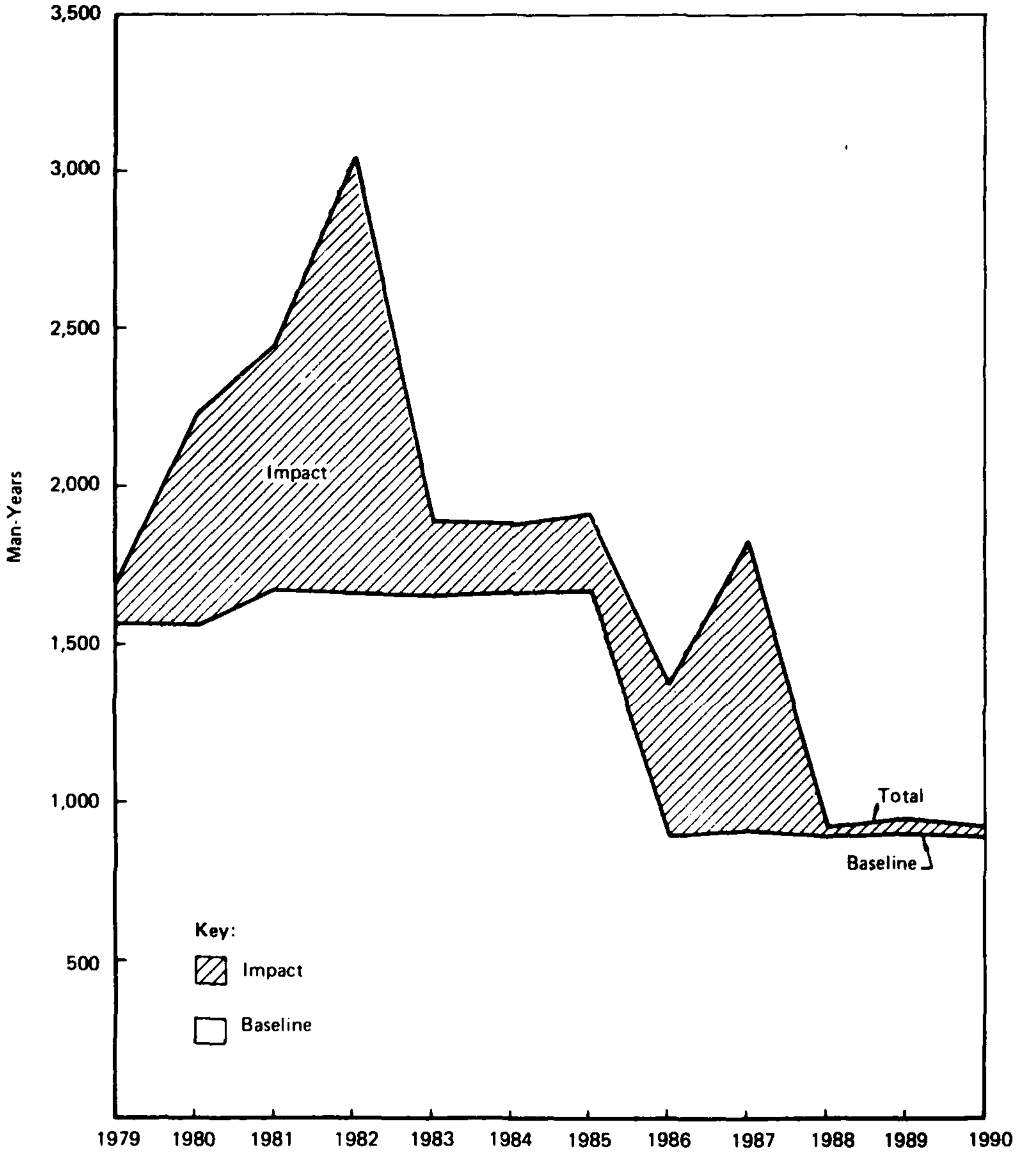
Table 4-70

Construction Labor Requirement for New Housing Under Expected Baseline and Impact Conditions

	Number of Baseline Units	Baseline Construction Labor Requirements (Man-Years)	Impact Units Required	Impact Construction Labor Requirements (Man-Years)	Total Units	Total Construction Labor Required (Man-Hours)	Impact Labor Requirement as a Relative Percent of Baseline Labor Requirement
1979							
Local Study Area							
Conneaut	95	65	5	5	100	70	82
Springfield	40	25	0	0	40	25	0
Ohio Principal Study Area	365	315	40	35	405	350	11
Pennsylvania Principal Study Area	1735	1250	70	65	1805	1315	5
Total Study Area	2100	1565	110	100	2210	1665	6
1982(1)							
Local Study Area							
Conneaut	95	65	585	470	680	535	720
Springfield	30	25	300	270	330	295	1080
Ohio Principal Study Area	530	405	1030	860	1560	1265	215
Pennsylvania Principal Study Area	1725	1265	575	520	2300	1785	40
Total Study Area	2255	1670	1605	1380	3860	3050	85
1987(1)							
Local Study Area							
Conneaut	50	25	390	310	440	335	1240
Springfield	25	15	155	140	180	155	935
Ohio Principal Study Area	230	165	650	585	880	750	355
Pennsylvania Principal Study Area	1075	745	385	345	1460	1090	45
Total Study Area	1305	910	1035	930	2340	1840	100
1990							
Local Study Area							
Conneaut	50	25	15	15	65	40	60
Springfield	25	20	0	0	25	20	0
Ohio Principal Study Area	220	155	25	20	245	175	15
Pennsylvania Principal Study Area	1075	740	15	15	1085	755	2
Total Study Area	1295	895	40	35	1330	930	4

(1) In actuality, the construction labor requirement must be on-going one year preceeding the peak residential requirement 1982 and 1987.

Source: Housing baselines, New Residential Housing Requirements Working Paper, SIMPACT IV Model.



Source: Housing baseline; New Residential Housing Requirements Working Paper; SIMPACT IV Model.

FIGURE 4–16 MANPOWER REQUIREMENTS FOR RESIDENTIAL CONSTRUCTION IN THE PRINCIPAL STUDY AREA

3,050 or by 85 percent during 1982 and from 910 to 1,840 or by 100 percent during 1987. A tight labor market for residential construction workers might be anticipated. Additionally, there would be competing construction in the Principal Study Area. However, it is likely that a relatively large proportion of the 3,050 man-year peak residential construction requirements could be met by local labor, given the nonunion characteristics of this type of employment. "The Erie Labor Market Profile," prepared in 1977 by the Erie Employment Task Force, showed a construction work force in Erie County alone of 3,100. Furthermore, 20 percent of the unemployed in Erie County listing structural work as their occupation implies a further 5,000-6,000 unemployed construction workers in the labor market area (slightly larger than the study area). Although the labor supply may be adequate, local area builder-developers may not be able to expand their organizations to meet the demand. For example, in the Local Study Area communities the demand for new housing units is projected to be two to three times the normal requirement. Several of the largest local builders in the Principal Study Area building 40-60 homes per year may meet the expected demand with careful planning and financial assistance. However, the increased demand in Conneaut and Springfield may be large enough to appeal to a larger-scale outside developer.

Utility Requirements

4.142

Sanitary Wastewater Collection and Treatment. The major item of relevance for housing is the ability of the study area communities to service the additional housing units in a timeframe coincident with the market demand. Most of the area which can be developed north of Interstate Route 90 between Saybrook and Erie City (with the exception of Springfield Township and East Springfield Borough) is expected to have sewage service by 1990 under baseline conditions. In Conneaut, existing plans for sewer interceptors, if implemented, would be sufficient for the plant-related population, although some additional laterals and expansion of the treatment plant may be required. However, Springfield Township and East Springfield Borough currently have no plans to provide sewer service. In Springfield, the need for additional sewage service could become critical by 1982, at which time the plant-related increase in population is expected to have reached 1,400. It is likely that, unless prompt action is taken to initiate such provision, residential developers could proceed only if they are willing to provide packaged treatment plants. Under these conditions, it is, therefore, more likely that the demand for housing would be less in Springfield. In Ashtabula City, only minor additions to existing and planned interceptors are projected to meet impact demands. The Erie City Service Area would require small expansions of the planned interceptor network and the treatment

plant. In the remainder of the Principal Study area, the Lakefront Plant-related population of less than 1,000 would be sufficiently distributed so that its effect on sewage facilities would be minimal.

4.143
Water Supply. Existing water supply facilities show an excess of capacity in relation to baseline requirements in most parts of the Coastal Communities. Therefore, expansion required to accommodate the plant-related increase in population is likely to be small. In the Springfield area, there is presently no water distribution system. It is assumed, however, that such a system could be installed by 1983. Due to the relatively inadequate groundwater supplies, development in Springfield before 1983 would be limited by an inadequate water supply. Thus, it is likely that the 1982 peak housing demand may not be met by that community. In other Coastal Communities, the groundwater supply is slightly more favorable, and development could proceed in the absence of a water distribution system as long as sewage lines are installed to prevent contamination of the aquifers.

Institutional Restraints

4.144
Land use controls are effectively in the hands of the individual townships and municipalities in both the Ohio and Pennsylvania Regional Study Areas. Present zoning and subdivision regulations and the amount of area allocated to individual zoning categories will probably not pose restraints for the pattern of development projected as the result of combined baseline and plant-related growth. Once again, the only exception appears to be in Springfield, where both the township and borough have recently adopted new zoning and subdivision ordinances. These ordinances have the effect of limiting construction to one-acre single-family housing unless lots are serviced by centralized sewage and water systems. If sewage systems are not installed by the local Governments, developers could provide packaged systems, but probably only for larger developments. Such systems would place half-acre lots in conformance with the ordinances, but the quarter-acre single-family and townhouse development projected for Springfield might not occur unless both water and sewage services are available. However, most of the Principal Study Area communities are revising and upgrading their building and subdivision codes to accommodate orderly growth. The ability of the area's small communities and boroughs to efficiently approve subdivision plans and streamline the procedures for obtaining sewage, water, and building permits could affect the ability of the construction industry to meet the housing demands in the short term.

Impact on Market Value and on Rents

Average Value of the Housing Stock

4.145
The cost of producing each type of housing unit is assumed to remain constant in terms of real purchasing power of the dollar, over the study period. Projections of changes in the average value of the housing stock come about as the result of shifts in the composition and growth of demand, or the number and composition of the housing stock corresponding to the distribution of households by income and size. The average income of construction (and operations) related households will be slightly higher than the corresponding baseline households. Consequently, they should be able to afford more expensive housing than baseline households. The average market value is not projected to change due to a change in the general types of housing constructed. However, within the general housing type categories, the plant-related households probably will exert a demand for more expensive units or for improved existing homes. The effect which the average market value for the Lakefront Plant-related housing requirement will have on the entire housing stock is expected to vary for individual communities. In Springfield and Conneaut where the plant-related housing requirement substantially increases the baseline stock, the average market value of the existing stock is expected to correspond more closely with the impact value. For Kingsville and Ashtabula Township, the impact growth is almost equal to the baseline growth (refer to Table 4-68). The average impact market value should increase slightly the overall value of the housing stock. In the Pennsylvania portion of the Principal Study Area, the plant-related requirement is a smaller proportion of the total stock, and its effect on average market values could be less significant. In a housing market which already has limited options for lower income households, the projected increase in the average value of the Lakefront Plant-related housing requirement will not increase the supply of lower income housing. The existing lower income household, which is already being forced out of the single-family housing market, may face an increased shortage of housing options due to the projected requirements associated with the Lakefront Plant. The urgency of the demand for publicly assisted housing, particularly for the elderly, may increase if rents were to escalate due to the influx of the Lakefront Plant-related population.

The Market Response to the Increased Demand for Housing

4.146
Supply Restrictions. Problems may occur where there is a rapid increase in demand and residential builders are unable to meet this demand. The process of land development and building construction is

lengthy. For example, the initial plans must be made 1-1/2 to 2 years before the housing is ready to be occupied. The opposite can also occur if demand suddenly drops and the builder is left with unsold inventory. Also, there are many individual facets within the housing market. A sudden increase in households seeking small, low-rent apartments in one locality is not immediately accommodated by single-family housing in another locality. In other words, construction may be right in volume, but wrong in composition. Even if builders intend to provide the right volume and mix of housing, scarcity of labor or materials or utility or institutional restrictions may delay construction or cause it to be more expensive. For the Principal Study Area, the relatively small projected increase in the housing stock, the consistency in housing type composition, the abundance of labor for residential construction, and the utility and institutional structure of most areas would probably indicate no major disturbance of housing market activity due to the proposed Lakefront Plant. However, the Local Study Area submarket of the Principal Study Area could possibly experience a shortage of supply, particularly in the initial years of the study period. The projected increases in the housing stock in Conneaut and Springfield are predicted to be substantial and quite rapid. The same is true of Kingsville and Ashtabula Township. However, in Springfield the lack of adequate sewer infrastructure will probably constrain new housing construction. Delays in provision of this type of infrastructure could only be overcome by developer-installed systems or installations of community wide sewage systems. This could increase selling prices, create delays since permits will be needed, and create more uncertainty for builders. Development might, as a result, be diverted to other nearby communities.

4.147
Another source of potential misalignment between supply and demand could occur in the construction labor market. Since the demand is so closely associated with the U.S. Steel work force, and because the timing of the build-up and the household characteristics of this work force can be so closely estimated in advance, production is likely to be able to keep pace. However, despite the abundance of labor, the area is currently characterized by numerous individual small builders constructing two to four homes per year and by several moderate size builder-developers, completing 40 to 60 homes each year. The initial peak year (1982) requirement increases the baseline housing requirement by 245 percent in Springfield and by 190 percent in Conneaut (refer to Figure 4-15). Initially, these builders may not be able to equip themselves financially and structurally for the increased demand. Consequently, the prices of existing homes or newly constructed units may increase. The relatively low turnover rate which currently exists in the Principal Study Area could also create a shortage in the supply of existing homes for in-migrant residents.

In the initial years of the study period, when the supply of new housing is minimal, the increased demand for housing could be met by existing units. The communities of the Principal Study Area are characterized by a limited number of homes for sale or rent. An increased demand could lower the turnover rate of existing homes, especially in the Local Study Area communities, creating an even tighter housing market. However, once new residential construction begins, original residents may seek new accommodations due either to an increased income spurred by new economic activity in the area or because of a wider variety of housing options. The pressure on the demand for existing homes may subside and prices could normalize.

4.148
Speculative Demand. Another source of temporary price fluctuation results from speculative demand, either for potentially suitable land, or for existing housing. Much of the speculative demand for land or existing housing may already have occurred before the onset of the initial construction phase for the proposed facility. Such speculation is inevitable given the projected size of the proposed Lakefront facility and its associated effects. The type or the degree of this speculation and its effect on market activity are impossible to quantify. The scenario for the Principal Study Area indicates that by 1990, five percent of the baseline housing stock could be occupied by in-migrants related to the Lakefront Plant activity. Such a small influx would appear to be an inadequate basis for sustained speculative activity. For the Local Study Area and several of the Coastal Communities, and for the peak residential demand periods, the scenario is different. In the Local Study Area, the greater proportionate increase in new housing requirements and the abundance of land might attract speculative developers. However, the projected utility limitations in Springfield could create a greater infrastructure cost in that community which could either dissuade speculative interest or be passed on to prospective homebuyers in the form of price increases. In either case, the housing demand will probably become less concentrated in this area. Growth in the total housing demand may be channeled into the demand for existing housing. The anticipation that this demand will cause price inflation may lead to holding existing housing for greater-than-normal capital gains. If the bottlenecks in supply and demand of existing housing previously mentioned do occur, then the existing housing stock may appreciate in value more rapidly than usual during the initial study period and as such speculation may occur. In both instances, speculative demand may raise prices in the early stages of the study period, which should subside once the supply of housing is sufficient to meet the increased demand.

Education Services

a) General Education

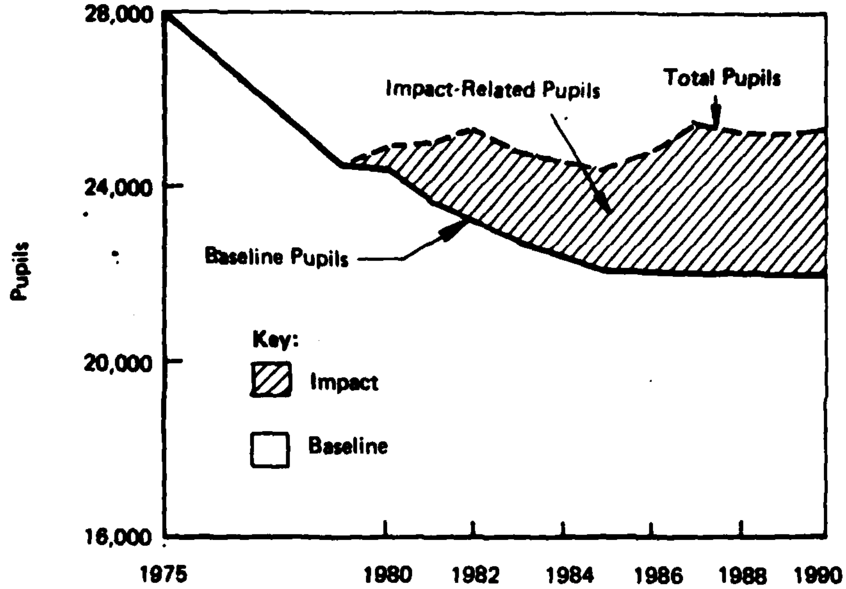
Enrollments*

Total Study Area

4.149
The proposed U.S. Steel construction and operating activity and related secondary development would moderately increase overall enrollments in the public school systems of the Local and Principal Study Areas. The Total Study Area would experience a maximum increase in enrollment of 15 percent over baseline by 1990. This increase would bring the total (impact and baseline combined) public school enrollments in 1990 to 25,455 pupils, which would still be less than the 1975 total of approximately 27,985 enrollees. The baseline versus the expected impact-related enrollments is displayed in Figure 4-17. Essentially, it indicates that between 1975 and 1990, baseline enrollments would decrease by about 5,800 pupils (from 27,985 to 22,175), while impact-related enrollment would increase to 3,280. This increase will offset over 50 percent of the baseline enrollment decline resulting in a net decrease in enrollment from 1975 to 1990 of about 2,500 or nine percent (refer to Table 4-71). To determine the significance of these impacts, changes in Total Study Area enrollments must be broken down by specific school districts. The resulting magnitude of impact varies for each individual school district, depending on its baseline enrollment trends and the expected influx of development-related pupils. All seven school districts are expected to receive different proportions of impact-related pupils with operations-related pupils concentrated largely in the Local Study Area. The operations-related pupils entering Conneaut Area City District or Northwestern District schools constitute more than 50 percent of the total increase in enrollments generated by the proposed facility and related development. However, construction-related pupils would be scattered in slightly varying proportions throughout the total area with fewer expected to reside in the Northwestern and Girard School Districts.

4.150
The expected overall distribution of pupils between operations versus construction-related U.S. Steel and associated development is presented in Figure 4-18. Construction-related pupils would account for a small proportion of the total impact-related enrollments and would

* All enrollments are given as full-time equivalent pupils. Each kindergarten and half-time vocational pupil is counted as 0.5 pupil, while full-time vocational pupils are subtracted altogether.



Source: Education Services baseline; Education Services Working Paper; SIMPACT IV Model.

FIGURE 4–17 BASELINE VERSUS IMPACT-RELATED PUBLIC SCHOOL PUPILS IN THE COASTAL COMMUNITIES – 1975-1990

Table 4-71

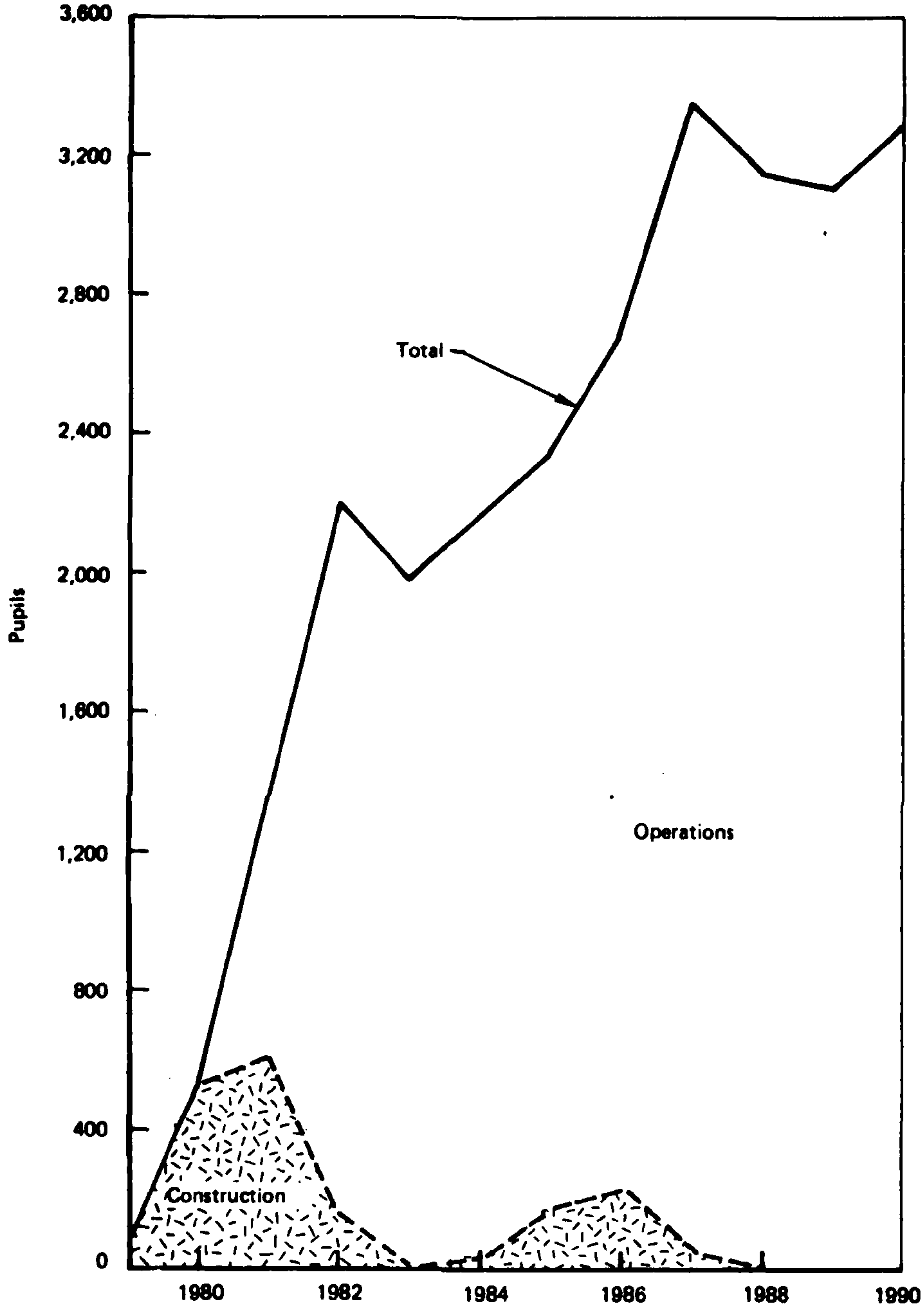
Highlights of Enrollment Projections -- Baseline Versus Impact-Related Pupils -- 1975-1990(1)

Impact-Related Enrollment Increase	1975	1979	1981	1986	1990
Local Study Area	-	5	360	1,420	1,915
Principal Study Area	-	55	860	1,260	1,365
Total Study Area	-	60	1,220	2,680	3,280
Baseline Enrollment					
Local Study Area	5,925	5,365	5,155	4,860	4,885
Principal Study Area	22,060	19,405	18,550	17,265	17,290
Total Study Area	27,985	24,770	23,705	22,125	22,175
Total Enrollment (with Impact)					
Local Study Area	5,925	5,370	5,515	6,280	6,800
Principal Study Area	22,060	19,460	19,410	18,525	18,655
Total Study Area	27,985	24,830	24,925	24,805	25,455
% Increase Over Baseline Attributable to Impact					
Local Study Area	-	*	7%	29%	39%
Principal Study Area	-	*	5%	7%	8%
Total Study Area	-	*	5%	12%	15%

*Less than 0.5%.

(1) All enrollments are given as full-time equivalents.

Source: See Tables 4-57 and 4-58.



Source: Education Services Working Paper; Population impact section of Chapter 4; SIMPACT IV Model.

FIGURE 4–18 PUBLIC SCHOOL PUPILS RELATED TO CONSTRUCTION AND OPERATION OF THE PROPOSED FACILITY AND RELATED DEVELOPMENT – 1979-1990

generally fluctuate with the level of construction activity. With the first-phase construction activity peak in 1981, 600 pupils would be enrolled in public schools in the Total Study Area. As construction activity declines in 1982 and finally halts in 1983, these construction-related families may leave the area to seek other employment or remain in the area in jobs not related to U.S. Steel. Step II construction from 1984-1986 would lead to 225 additional pupils in the peak second-phase construction year of 1986; and drop off in 1987-1988. Even in the peak year of second-phase construction, construction-related pupils would constitute only about eight percent of the increase in total enrollments attributable to the impact development and only a one percent increase over 1986 baseline enrollments. Operations-related pupils are expected to begin entering the public school systems in 1981. During the first phase of U.S. Steel operations, pupils would initially number about 700 and rise to about 2,450 by 1986. With the onset of the second operational phase in 1987, the increase in Total Study Area enrollments due to operations-related pupils would range from about 3,350 in 1987 to 3,100 in 1989 and 3,300 in 1990.

Local Study Area

4.151
Both Conneaut Area City and Northwestern School Districts would experience a substantial influx of new pupils as a result of the proposed plant. Together they would receive, in most years, 50-60 percent of the operations-related pupils. However, when compared to the school districts in the Principal Study Area, the Local Study Area is expected to receive a small proportion of the total number of construction-related pupils (about 20 percent in both 1981 and 1986, the peak construction years). The projections of impact-related enrollments compared with the baseline forecasts in each of the two school districts are shown in Figures 4-19 and 4-20. During the 1975 to 1990 period, baseline enrollments in the Local Study Area are expected to decline by 1,040 pupils, while, under impact conditions, in 1990 the pupils added by the proposed facility and related activity would reach 1,915. Essentially, the effect of the proposed Lakefront Plant and related activity in the Local Study Area would be to reverse the projected baseline trend of declining enrollments and, by 1990, surpass 1975 enrollment levels by 875 pupils. Conneaut Area City School District would receive about 1,200 (64 percent) of the 1,900 impact-related pupils in the Local Study Area. These additional pupils, as shown in Table 4-72, would cause Conneaut Area City enrollments to climb from 3,290 in 1975 to 3,900 in 1990. The increase over baseline enrollments ranges from 24 percent to 32 percent in the 1982-1986 period and, post-1987, from 44 percent to 46 percent. Compared with the Conneaut Area City District, the Northwestern District would experience less impact due to U.S. Steel

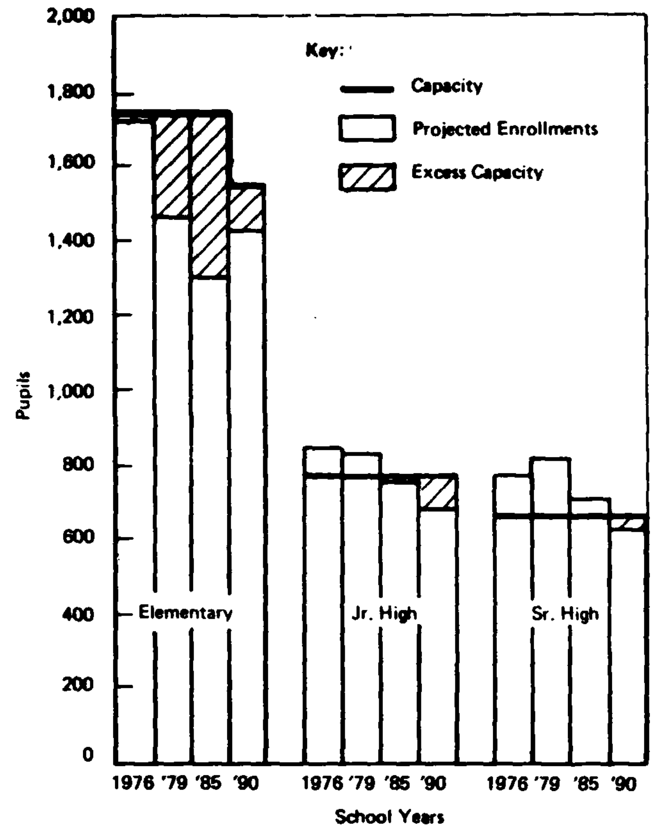


FIGURE 4–19 CONNEAUT AREA CITY SCHOOL DISTRICT: CAPACITY ESTIMATES – 1976–1990

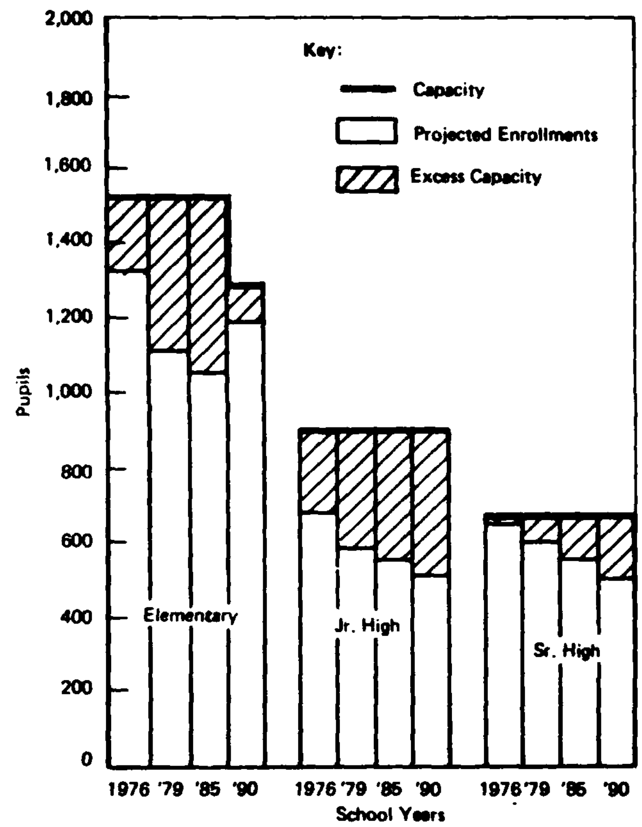


FIGURE 4–20 NORTHWESTERN SCHOOL DISTRICT: CAPACITY ESTIMATES – 1976–1990

Table 4-72

Impact-Related Pupils as Increments Over Baseline Enrollments in the Local Study Area -- 1975-1990(1)

Number of Pupils	1975	1979	1981	1986	1987	1990
School District						
Conneaut Area City						
Construction-Related	-	5	85	30	10	0
Operations-Related	-	0	145	845	1190	1225
Total Impact	-	5	230	875	1200	1225
Baseline	3290	3085	2965	2735	2720	2680
Impact as % increase over Baseline	-	*	8%	32%	44%	46%
Total (Impact and Baseline)	3290	3090	3195	3610	3920	3905
Northwestern						
Construction-Related	-	0	40	15	0	0
Operations-Related	-	0	90	530	680	690
Total Impact	-	0	130	545	680	690
Baseline	2635	2280	2190	2125	2135	2205
Impact as % increase over Baseline	-	-	6%	26%	32%	31%
Total (Impact and Baseline)	2635	2280	2320	2670	2815	2895

*Less than 0.5%.

(1)All enrollments are given as full-time equivalents.

Source: Education Services Working Paper; Education Services baseline; SIMPACT IV Model.

and associated activity as shown in Table 4-72. During the first phase of operations, impact-related pupils climb from 130 in 1981 (constituting a six percent increment over the baseline enrollment of 2,190) to 545 in 1986 (which is a 26 percent increase over the 2,125 baseline pupils). Second-phase operations during 1987 to 1990 bring the number of impact pupils to nearly 700 for a 32 percent increase over baseline enrollments (about 2,200).

Principal Study Area

4.152
The Principal Study Area would experience low to moderate impact. Except for the Girard School District, the addition of impact-related pupils to baseline enrollments in any one year would yield a total still well below the 1975 enrollment level. The enrollments generated by the construction and operation of the proposed plant and associated development as they compare with baseline enrollments in selected years of plant activity are presented in Table 4-73. The Buckeye and Girard Districts would receive the larger percentage increases in enrollment, in most years, these impacts would vary between approximately 10 percent and 20 percent over baseline levels. Although Ashtabula Area City District would receive approximately the same number of additional pupils as Buckeye, the impact in relation to Ashtabula's larger baseline enrollments would be small. Similarly, the Fairview District would receive only slightly more pupils than the Millcreek District but, because of smaller baseline enrollments, the maximum impact would be about nine percent compared with an increase of two percent in Millcreek. Most construction-related pupils are expected to attend schools in the Principal Study Area. These pupils, as indicated in Table 4-73, would be distributed fairly evenly across the Principal Study Area with the exception of Girard. Relatively few construction workers moving into the area with children are expected to reside in the Girard School District.

Facilities

4.153
Several considerations affect the capacity of the various school districts to accomodate the impact-related pupils in existing school facilities including standards for the number of pupils per classroom and facility utilization; baseline enrollment trends; existing condition of school facilities; baseline plans to expand or contract facilities, and, proximity of additional population to schools within the school district and local policies regarding busing. In view of these considerations, capacity estimates were compared with enrollment forecasts in order to assess the additional seating requirements as a result of the proposed plant and associated activity. Capacity estimates are based on an assumed standard of 25

Table 4-73

Impact-Related Pupils as Increments Over Baseline Enrollments in the Principal Study Area -- 1975-1990(1)

Number of Pupils	1975	1979	1981	1986	1987	1990
School District						
Buckeye						
Construction-Related	----	20	135	50	10	0
Operations-Related	----	0	135	365	470	480
Total Impact	----	20	270	415	480	480
Baseline	3390	3050	2920	2605	2590	2540
Impact as % of Baseline	----	1%	9%	16%	19%	19%
Ashtabula						
Construction-Related	----	5	90	30	5	0
Operations-Related	----	0	105	315	410	380
Total Impact	----	5	195	345	415	380
Baseline	6390	5770	5530	5010	4980	4885
Impact as % of Baseline	----	*	4%	7%	8%	8%
Girard						
Construction-Related	----	5	45	15	0	0
Operations-Related	----	0	60	220	300	275
Total Impact	----	5	105	235	300	275
Baseline	1985	1755	1700	1675	1685	1730
Impact as % of Baseline	----	*	6%	14%	18%	16%
Fairview						
Construction-Related	----	15	95	40	10	0
Operations-Related	----	0	60	120	135	130
Total Impact	----	15	155	160	145	130
Baseline	2260	1880	1845	1820	1840	1885
Impact as % of Baseline	----	1%	8%	9%	8%	7%
Millcreek						
Construction-Related	----	10	110	45	10	0
Operations-Related	----	0	25	60	110	100
Total Impact	----	10	135	105	120	100
Baseline	8035	6950	6555	6155	6180	6250
Impact as % of Baseline	----	*	2%	2%	2%	2%

*Less than 0.5%.

(1) All enrollments are given as full-time equivalent

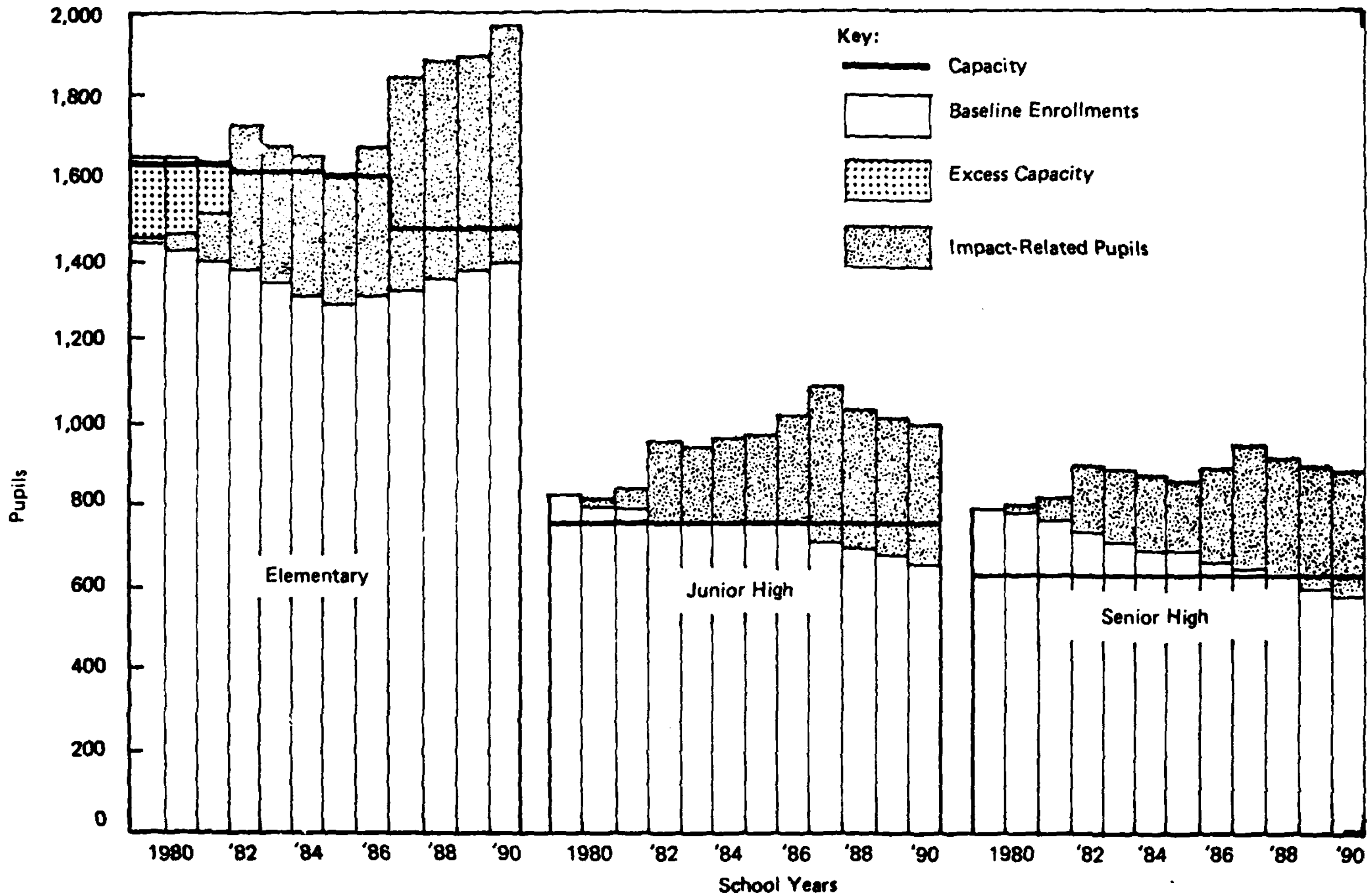
Source: Education Services Working; Education Services Baseline; SIMPACT IV Model.

pupils per classroom and include assumptions regarding the longevity of facility use. Some facilities, particularly those in Ohio, are old and occupy small, inadequate sites. It is assumed that several of these older schools would be phased out of use under baseline conditions. For the majority of the school districts, declining baseline enrollments over the 1975 to 1990 period would result in an increase in the number of seats available within existing usable facilities, thereby enabling the districts to adequately accommodate the plant-related pupils. The Conneaut and Northwestern School Districts would require three or four new facilities (or additions to facilities) due to the increased population generated by U.S. Steel and associated development. However, expansion programs adopted by any one of these districts will depend on the ultimate use of existing facilities and whether or not older buildings would be phased out as a part of the process.

Local Study Area

4.154

An influx of plant-related pupils could impact some Conneaut Area City District schools more than others. Since it is likely that these pupils would be concentrated in developing residential areas, the elementary schools in closest proximity to pupil concentrations could experience greater pupil demand than the relatively inaccessible schools. To distribute the pupils more evenly, Conneaut could re-draw elementary school attendance boundaries and, with busing, fill every available seat in the elementary schools. However, the busing distances and associated transportations costs could make this option impractical. For example, the number of available seats in the Monroe School, which is located in Monroe Township, could be fairly inaccessible to pupils clustered in the urbanized area of Conneaut City. In view of this consideration, capacity estimates are based on the assumption that about 75 percent of the available elementary seats would be accessible to the plant-related increase in pupils. The increase in plant-related pupils would require seats exceeding Conneaut's existing elementary capacity beginning in 1982 (as shown in Figure 4-21). In 1982, the anticipated start-up date for U.S. Steel operations, elementary capacity would be exceeded by about 100 pupils as a result of the proposed facility and related activity. Nonetheless, it is expected that Conneaut elementary schools could handle the additional pupils by increasing class size or adding temporary, portable classrooms. This approach could be taken since the seating problem is only temporary and is anticipated to lessen in succeeding years to 1986. The Conneaut School District handled this enrollment level in 1976 and could probably do so again if required. Elementary facility expansion, however, would become necessary by 1987. As shown in Table 4-74, the elementary school seats required by plant-related pupils from 1987 to 1990 would exceed



Source: Education Services baseline; Education Services Working Paper; SIMPACT IV Model.

FIGURE 4–21 BASELINE CAPACITY ESTIMATES VERSUS IMPACT-RELATED PUPILS IN THE CONNEAUT AREA CITY SCHOOL DISTRICT – 1979-1990

Table 4-74

Additional Seating Required by Impact-Related Pupils Versus Seats Available -- 1979-1990[1]

School District	1979 Seats Available	1979 Impact-Related Pupils	1979 Additional Seating Required	1981 Seats Available	1981 Impact-Related Pupils	1981 Additional Seating Required	1986 Seats Available	1986 Impact-Related Pupils	1986 Additional Seating Required	1987 Seats Available	1987 Impact-Related Pupils	1987 Additional Seating Required	1990 Seats Available	1990 Impact-Related Pupils	1990 Additional Seating Required
Local Study Area															
Conneaut Area City[2]															
Elementary (K-6)	300	3	0	245	120	0	310	365	55	140	515	375	90	575	485
Jr. High (7-9)	(-5)	1	1	30	35	25	85	285	200	100	305	205	155	345	190
Sr. High (10-12)	(-160)	1	1	(-135)	55	55	(-40)	220	220	(-20)	295	295	35	305	270
Northwestern[3]															
Elementary (K-6)	410	0	0	440	70	0	450	235	0	170	305	135	80	335	255
Jr. High (7-9)	360	0	0	345	30	0	365	175	0	375	215	0	395	190	0
Sr. High (10-12)	70	0	0	95	30	0	160	130	0	170	100	0	195	165	0
Principal Study Area															
Buckeye Local															
Elementary (K-6)	180	11	0	245	145	0	350	175	0	330	215	0	275	230	0
Jr. High (7-9)	70	5	0	120	65	0	230	135	0	245	155	0	290	135	0
Sr. High (10-12)	(-30)	5	5	0	65	65	90	100	15	105	115	10	165	115	0
Ashtabula Area City															
Elementary (K-8)	1,190	3	0	1,325	135	0	1,305	205	0	1,365	245	0	1,330	255	0
Sr. High (9-12)	430	2	0	535	60	0	795	145	0	865	170	0	985	125	0
Girard															
Elementary (K-5)	175	2	0	100	45	0	170	75	0	145	100	0	85	110	25
Middle (6-8)	80	1	0	85	25	0	100	60	0	95	75	0	85	75	0
Sr. High (9-12)	330	2	0	345	35	0	400	100	0	410	125	0	440	95	0
Fairview															
Elementary (K-5)	550	6	0	550	65	0	535	50	0	510	50	0	445	50	0
Middle (6-8)	225	4	0	295	60	0	250	45	0	245	60	0	235	35	0
Sr. High (9-12)	195	5	0	205	50	0	245	65	0	255	60	0	285	45	0
Millcreek															
Elementary (K-6)	1,090	6	0	1,180	70	0	1,315	45	0	1,230	50	0	1,080	50	0
Jr. High (7-9)	270	2	0	290	20	0	360	20	0	370	25	0	395	20	0
Sr. High (10-12)	445	4	0	500	40	0	930	40	0	975	50	0	1,180	35	0

(1) All pupils are given as full-time equivalents: Seats available are derived from capacity estimates, using a standard of 25 pupils per classroom or teaching station and 85% utilization in secondary grades and baseline enrollments.

(2) Estimates of seats available in Conneaut elementary schools are based on an assumption that only 75% of seats would be accessible to impact pupils. They also assume phasing out a 200-pupil school by 1987.

(3) Northwestern elementary seats available assume West Springfield Elementary would be phased out of use by 1987.

Source: Education Services baseline; Education Services Working Paper; Simpact IV Model.

the available seats by 400-500 if the phase-out of a 200-pupil elementary school (assumed under baseline conditions) does occur. To accommodate the plant-related influx of pupils beyond present capacity, the Conneaut District could build a new elementary school for 500 pupils (55,000 square feet), which would be opened in the 1987-88 school year. An alternative to new school construction is building additions to several elementary schools, although implementing this option may be difficult due to the small sizes of existing sites, except for Chestnut Elementary. If Conneaut should elect not to close one of its older elementary schools, as is assumed to occur under baseline conditions, the elementary school construction requirement could be reduced to a 300-pupil facility.

4.155
According to capacity estimates which are based on 25 pupils per classroom and 85 percent utilization of the facility, the present capacity of Conneaut's junior high would be exceeded by about 150 additional pupils beginning in 1982 and by about 200-300 throughout the 1986-1990 period, (refer to Table 4-74). However, the current school district administration considers it feasible to utilize the junior high at 100 percent capacity. On the basis of 100 percent utilization, Rowe Junior High has capacity for 975-1,000 pupils compared with the 825-pupil capacity estimate based on 85 percent utilization. With 100 percent utilization, the school could be capable of handling the development-related pupils through 1985, but during 1986-1990, as shown in Table 4-75, the number of additional seats required would range from 55-135, with 135 as the peak requirement in 1987. Although Conneaut could undertake construction for the seating of 200-250 pupils as required under the 85 percent utilization scheme, it is more likely that the school would be used at the 100 percent level, as school officials have indicated. In that event, Conneaut could build a 125-pupil addition of four-five classrooms (17,000 square feet) to Rowe Junior High School in 1985 which would open for the 1986 school year. In the interim, portable classrooms could be used to supplement existing facilities.

4.156
Conneaut Senior High would have no capacity to handle development-related pupils until the mid-1980's, (refer to Table 4-75). At that time, a few seats would become available as baseline enrollments decline, but they would be insufficient to handle all of the impact-related pupils. Similar to capacity estimates for Rowe Junior High School, the estimates shown in Table 4-75 are based on 85 percent utilization, resulting in a total senior high school capacity of 640 pupils. Currently, Conneaut Senior High accommodates 765 pupils which represent a 100 percent utilization level. The existing senior high has inadequate core facilities which the school district has sought to improve and expand in three consecutive but unsuccessful

Table 4-75

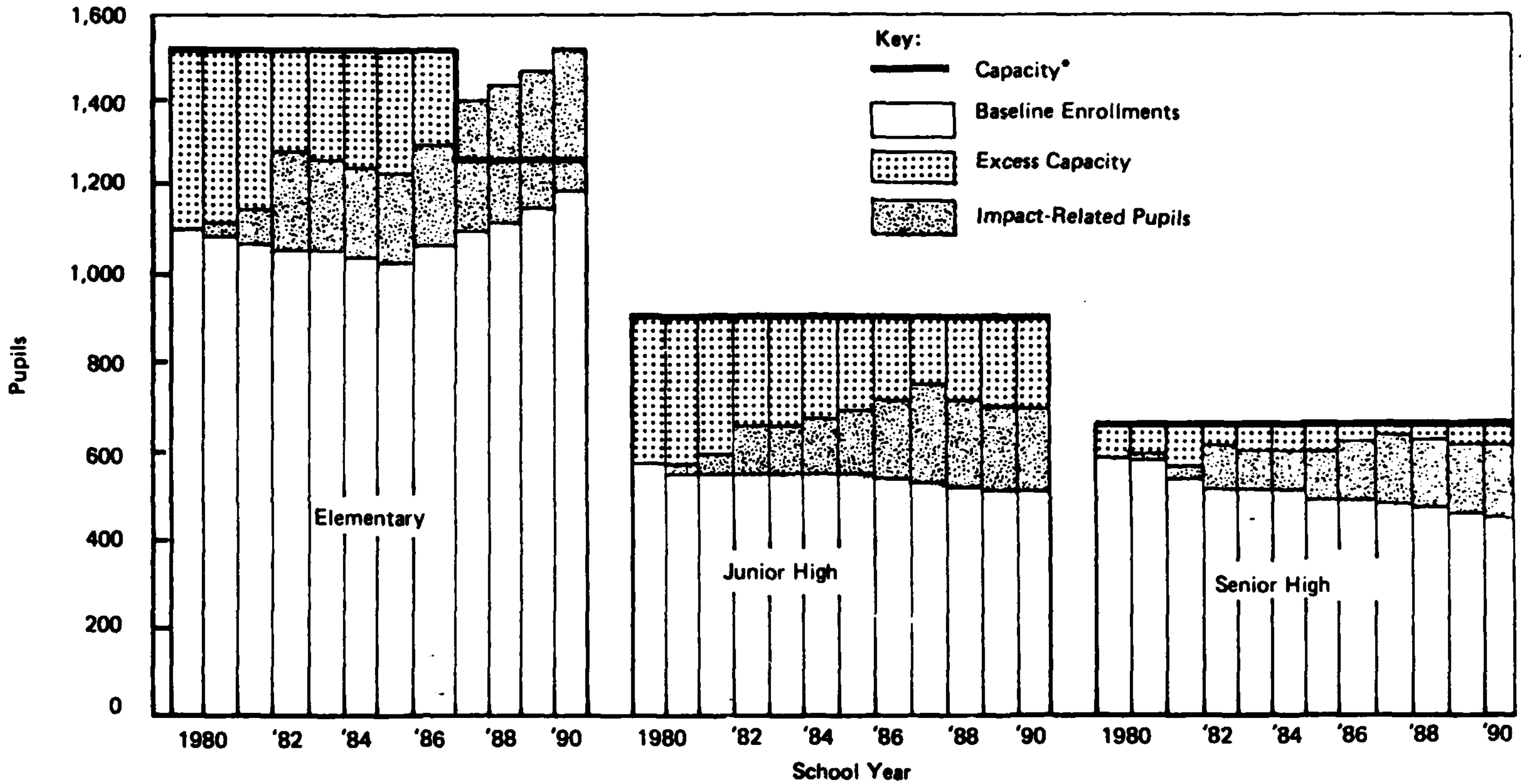
Rowe Junior High Capacity Estimates -- 1979-1990

	1979	1981	1982	1986	1987	1990
Development-Related Pupils	1	55	180	285	385	345
100% Utilization						
Capacity	975	975	975	975	975	975
Seats Available	155	80	190	235	250	300
Additional Seats Required for Development-Related Pupils	0	0	0	55	135	40
85% Utilization						
Capacity	825	825	825	825	825	825
Seats Available	(-5)	30	35	85	100	155
Additional Seats Required for Development-Related Pupils	1	25	145	200	285	190

Source: Arthur D. Little, Inc.

bond issue ballotings. According to the current school district administration, an expansion program for moderate future growth could occur at the existing school facility. However, such an expansion program would be limited by the school's existing small site which is abutted by dense residential development. In light of the consideration that the Conneaut Area City School District would likely not abandon the existing senior high and leave an unoccupied facility, a moderate expansion program based on the 100 percent utilization scenario could be studied for its feasibility. Under this plan, the peak seating requirement of 200 pupils occurs in 1987; although the seating requirement lessens in succeeding years, construction of a 200-pupil addition may provide greater utilization flexibility. The 200 pupil addition of 30,000 square feet would need to be constructed during 1981 and opened in 1982 to provide spaces for the development-related pupils who otherwise would not be accommodated. It would not be fully utilized, however, until 1986-1987.

4.157
Northwestern School District. Through 1986, the three elementary schools in the Northwestern School District are expected to have sufficient capacity to handle the development-related pupils (see Figure 4-22 and Table 4-74). However, in 1987 capacity would be reduced by 250 seats, since it is likely that West Springfield Elementary School would be phased out. If West Springfield is phased out by 1987, reducing capacity by 250 seats, the plant-related increase of 135 students in 1987 and 255 in 1990 would necessitate new facility construction. The required number of additional seats could be created by expanding the East Springfield Elementary School, which is located in Springfield Township. Alternatively, Northwestern could expand the Northwestern Elementary School and bus pupils to the Albion campus. In either event, a new facility or addition having an area of 27,500 square feet would be needed with construction expected to proceed in 1987. If the construction is to occur at the East Springfield Elementary School it would require expansion of the site by about four acres. Alternatives to constructing an elementary school addition would include increasing class size and maintaining the West Springfield facility. An educational facilities planning study, including an analysis of post-1990 projections of elementary aged population, would assist in determining the feasibility of the various options. Northwestern's junior and senior high facilities would have sufficient capacity to accommodate the plant-related increase in pupils. The baseline capacities of the schools in this district and the impact of the plant-related increase in pupils are illustrated graphically in Figure 4-22. In 1987, when plant-related pupils reach a peak of 215, Northwestern Junior High would have 375 available seats. During 1979-1990, the excess capacity of the senior high school would be nearly filled by the additional pupils. However, this facility should be capable of housing these students.



*Capacity is based on the assumption that, by 1987, a 250-pupil elementary school would be phased out.

Source: Education Services baseline; Education Services Working Paper; SIMPACT IV Model.

FIGURE 4–22 BASELINE CAPACITY ESTIMATES VERSUS IMPACT-RELATED PUPILS IN THE NORTHWESTERN SCHOOL DISTRICT – 1979-1990

The peak total enrollment (baseline plus impact-related) in 1987 of 653 senior high pupils is still below the 1976 enrollment of 682; post-1987, senior high enrollments are expected to decline.

Principal Study Area

4.158
Each of the five school districts in the Principal Study Area is assumed to be capable of handling the plant-related pupils in its present facilities (refer to Table 4-74). Some of the school districts could experience total enrollment levels close to their present capacities, however, there would be little need for construction programs to expand facilities. One elementary school in the Girard School District is expected an enrollment in 1990 which exceeds capacity by 26 pupils. Assessment of population projections should be undertaken to determine post-1990 trends prior to determining the most appropriate action for accommodating the additional pupils. The overall increase could be solved through the use of portable classrooms or space in the neighboring senior high school. Throughout the projection period 1979-1990, the plant-related pupils would fill most of the available seats in Girard's middle school. During the period 1987 to 1990, the number of additional pupils is estimated very close to capacity levels, although the total number never reaches the level of 1976 enrollments. Therefore, it is expected that Girard could handle these pupils without expanding its present capacity. Girard's senior high school has substantial excess capacity. Plant-related enrollments would utilize only about 22 percent to 25 percent of the available seats throughout 1979-1990.

4.159
The Fairview, Millcreek, and Ashtabula Area City School Districts all have considerable capacity for accepting plant-related pupils. The seats made available by declining baseline enrollments would greatly exceed the expected number of additional pupils (refer to Table 4-74).

4.160
The Buckeye School District's elementary schools may be affected differently by plant-related increases in enrollment. Although the five elementary schools together have sufficient available seats for the additional pupils, these seats would not be uniformly accessible to pupils concentrating in the developing residential areas. The older North Kingsville Elementary School is at capacity and 50 percent to 70 percent of the pupils in the vicinity of this school are currently bused to the Ridgeview and Lincoln Elementary Schools in Ashtabula City which are currently underutilized. Pierpont Elementary is expected to be too far south to be accessible to the additional pupils. However, accessibility does not appear to be a problem since

the Buckeye School District has bused pupils extensively in the past and could do so again. As a consequence of the proposed project and the resultant change in geographic concentrations of pupils, Buckeye may need to shift school attendance boundaries. Braden Junior High would have adequate capacity throughout the 1979-1990 period, but impact-related pupils entering Buckeye Senior High School would cause slight crowding through 1987. The most crowded conditions are expected in 1981 and 1982 when about 65 pupils above capacity would require seating. Buckeye could handle the pupils by utilizing a greater percentage of the facility (i.e., more than 85 percent) increasing class size, or providing portable classrooms. These interim measures, rather than new facility construction, would be reasonable considering that the over-crowding situation will be alleviated in subsequent years.

Staff

4.161
Estimates of staff requirements are based on applying assumed standard rates of pupils per instructional, support, and administrative staff to both projected impact and baseline enrollments. Accordingly, the staff requirements shown in Table 4-76 parallel the projected enrollment trends under plant-related impact and baseline conditions. Under baseline conditions (1979-1990), school employment in the Total Study Area would decline from 1,885 staff in 1979 to 1,675 in 1990. Declining enrollments would be responsible for this reduction by 210 positions or about 10 percent. However, as a consequence of the construction and operation of the proposed plant, the decline in baseline enrollments would be reversed for the total study area. This change in enrollment trend will cause overall staff levels to remain constant during the projection period. Staff required for plant-related pupils increases throughout the period to 1990, when 246 employees would be needed, including 145 instructional staff, 83 support staff, and 18 administrative staff (refer to Table 4-76). Added to the Total Study Area's baseline staff estimates, the impact requirements yield a total staff level of approximately 1,900 throughout the 1979-1990 period. The majority of the staff requirements occur in the Local Study Area, where a larger share of impact-related pupils are expected to reside (refer to Table 4-76). The Conneaut Area City School District total staff requirement (baseline plus impact) would reach nearly 300 by 1990 or a 25 percent increase over the 1979 requirement. The Northwestern School District staff in 1990 would increase by 55 positions over the baseline level (170). Under plant-related impact conditions, the Principal Study Area would require a roughly constant staff level over the 1979-1990 period in constrast to the baseline enrollment decline, which would reduce staff requirements by about 10 percent.

Table 4-76

Staff Requirements for Impact-Related Pupils[1]

School District	1979	1981	1986	1990
Total Study Area				
Instructional Staff	3	50	130	145
Support Staff	1	35	68	83
Administrative Staff	-	7	17	18
Total Impact	4	92	215	246
Baseline	1,890	1,825	1,705	1,705
Local Study Area				
Instructional Staff	-	15	65	85
Support Staff	-	10	35	50
Administrative Staff	-	2	10	10
Total Impact	-	27	110	145
Baseline	415	400	375	375
Conneaut Area City				
Instructional Staff	-	10	40	55
Support Staff	-	7	20	30
Administrative Staff	-	1	5	5
Total Impact	-	18	65	90
Baseline	240	230	210	205
Northwestern				
Instructional Staff	-	5	25	30
Support Staff	-	3	15	20
Administrative Staff	-	1	5	5
Total Impact	-	9	45	55
Baseline	175	170	165	170
Principal Study Area				
Instructional Staff	3	35	65	60
Support Staff	1	25	33	33
Administrative Staff	-	5	7	8
Total Impact	4	65	105	101
Baseline	1,475	1,425	1,330	1,330
Buckeye Local				
Instructional Staff	1	10	25	20
Support Staff	1	10	10	10
Administrative Staff	-	2	2	3
Total Impact	2	22	37	33
Baseline	235	225	200	195
Ashtabula Area City				
Instructional Staff	-	10	15	15
Support Staff	-	5	10	10
Administrative Staff	-	1	2	2
Total Impact	-	16	27	27
Baseline	445	425	385	375
Girard				
Instructional Staff	-	5	10	15
Support Staff	-	2	5	5
Administrative Staff	-	1	1	1
Total Impact	-	8	16	21
Baseline	140	130	130	135
Fairview				
Instructional Staff	1	5	10	5
Support Staff	-	5	5	5
Administrative Staff	-	-	1	1
Total Impact	1	10	16	11
Baseline	145	160	140	145
Millcreek				
Instructional Staff	1	5	5	5
Support Staff	-	3	3	3
Administrative Staff	-	1	1	1
Total Impact	1	9	9	9
Baseline	510	505	475	480

[1] All staff are full-time equivalents.

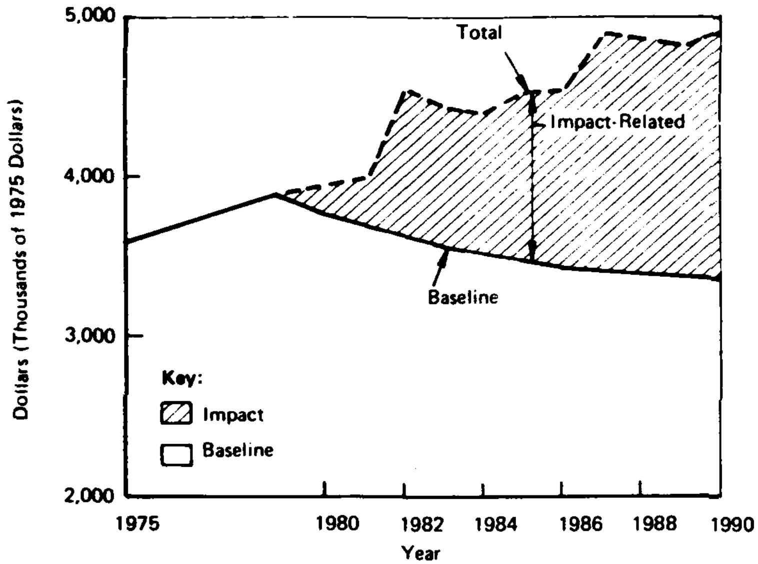
Source: Education Services baseline; Education Services Working Paper; SIMPACT IV Model.

Expenditures

Operating Costs

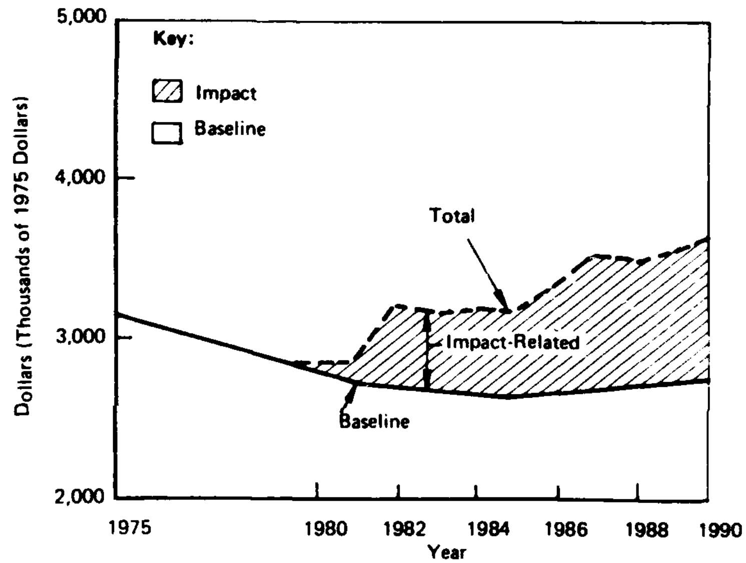
4.162
Operating cost estimates are based on the application of standard per-pupil operating costs to projections of both baseline and impact-related enrollments. Standard operating costs per pupil are derived from estimated ratios of pupils per staff and assumed proportions of operating costs for components such as salaries and materials. In all but two school districts, a standard of $1,250 per pupil is employed over the 1979-1990 period. The standard represents an increase over 1975 per-pupil costs in five of the seven school districts, reflecting an expected improvement in pupils to staff ratios. The 1975 operating costs per pupil were: Conneaut Area City @ $1,000; Northwestern @ $1,194, Girard @ $1,197; Buckeye @ $1,118; and Ashtabula Area City @ $1,060. The $1,250 per-pupil standard is not applied to Fairview and Millcreek School Districts. Instead, the higher 1975 per-pupil costs ($1,350 in Fairview and $1,275 in Millcreek) are used as standards since they are assumed to be the desired per-pupil allocations for both districts. The maximum impact on operating costs occurs in 1987, when the Total Study Area would require about $4.2 million to handle a plant-related increase of about 3,350 pupils. This amounts to an increase of approximately 15 percent over baseline operating expenditures in the Total Study Area, which parallels the 15 percent increase in enrollments. Since operating cost estimates are developed on a per-pupil basis, operating cost projections parallel enrollment projections under both baseline and operating conditions. Accordingly, the Local Study Area would experience effects substantially greater than those in the Principal Study Area, because relatively fewer impact-related pupils are expected to reside in the Principal Study Area.

4.163
Local Study Area. Operating expenditures in the Local Study Area resulting from U.S. Steel and associated activity are shown in Table 4-77 as a percentage increase over baseline expenditures. Plant-related impacts in the Local Study Area would occur in roughly three time periods: 1979-1981, 1982-1986, 1987-1990 (reflecting the construction and operational phases of the proposed facility). These data are presented in Figures 4-23 and 4-24. During 1990, Conneaut Area City School District is expected to expend $1.5 million for operating costs attributable to the 1,225 plant-related increase of pupils. This expenditure constitutes a 46 percent increase over baseline operating costs (refer to Table 4-77). Similarly, the Northwestern School District would experience maximum impact in 1987, when the additional operating costs of about $855,000 constitute a 32 percent increase over baseline operating costs.



Source: Education Services baseline; Education Services Working Paper; SIMPACT IV Model.

FIGURE 4–23 BASELINE VERSUS IMPACT-RELATED OPERATING COSTS, CONNEAUT AREA CITY SCHOOL DISTRICT – 1975–1990



Source: Education Services baseline; Education Services Working Paper; SIMPACT IV Model.

FIGURE 4–24 BASELINE VERSUS IMPACT-RELATED OPERATING COSTS, NORTHWESTERN SCHOOL DISTRICT – 1975–1990

Table 4-77

Impact on School District Operating Costs -- 1979-1990
(Thousands of 1975 Dollars)

School District	Year				
	1979	1981	1986	1987	1990
Conneaut Area City					
Impact Costs	5	285	1090	1495	1530
Baseline Costs	3860	3710	3420	3400	3350
Impact as a % of Baseline (1)	*	8%	32%	44%	46%
Northwestern					
Impact Costs	0	160	685	855	865
Baseline Costs	2850	2740	2655	2670	2755
Impact as a % of Baseline (1)	-	6%	26%	32%	31%
Buckeye					
Impact Costs	25	335	515	605	600
Baseline Costs	3810	3650	3255	3235	3175
Impact as a % of Baseline (1)	1%	9%	16%	19%	19%
Ashtabula					
Impact Costs	5	245	435	515	475
Baseline Costs	7210	6915	6265	6225	6105
Impact as a % of Baseline (1)	*	4%	7%	8%	8%
Girard					
Impact Costs	5	130	295	380	345
Baseline Costs	2195	2130	2090	2110	2165
Impact as a % of Baseline (1)	*	6%	14%	18%	16%
Fairview					
Impact Costs	20	205	215	195	175
Baseline Costs	2540	2490	2460	2480	2545
Impact as a % of Baseline (1)	1%	8%	9%	8%	7%
Millcreek					
Impact Costs	15	170	150	150	130
Baseline Costs	8475	8355	7850	7880	7970
Impact as a % of Baseline (1)	*	2%	2%	2%	2%

*Less than 0.5%.

(1) Impact as a % of baseline is the expected increase in baseline operating expenditures due to impact-related pupils.

Source: Education Services baseline; Education Services Working Paper; SIMPACT IV Model.

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4.164
Principal Study Area. The Girard and Buckeye School Districts would experience greater operating cost impacts than the other school districts in the Principal Study Area (refer to Table 4-77). The 485 impact related pupils attending Buckeye District schools in 1987 would cause a peak expenditure of $604,000 or about a 19 percent increment over baseline costs. In 1987, the Girard School District would experience a maximum of 300 pupils, costing $379,000, or an 18 percent increase. The Ashtabula, Millcreek, and Fairview School District operating costs would increase by less than 10 percent due to the influx of plant-related pupils. Peak year expenditures in both the Millcreek (1982) and Fairview (1986) Districts are about $200,000, which is a nine percent increase over the baseline budget for Fairview and a two percent increment for Millcreek.

Capital Costs

4.165
The Conneaut Area City School District could undertake three construction projects: a new elementary school, an addition to the junior high, and an addition to the senior high. Construction of the 30,000 square-foot addition to the senior high facility should begin in 1981 in order to be opened in time for the 1982 school year. The cost of this facility would be approximately $1.5 million in 1975 dollars. To allow occupation by 1987, construction of the 500-pupil elementary school (55,000 sq. ft.) should begin in 1986. The cost of this facility is estimated at $2.7 million. An addition to the junior high of about 17,000 square feet is estimated to cost $830,000 with construction beginning in 1985 to allow occupation by 1986. The Northwestern School District could undertake construction of a 250-pupil addition to East Springfield Elementary School in 1986 with an opening date of 1987. The addition would cost approximately $1.35 million.

b) Vocational Education

Enrollments and Capacity

4.166
Of the additional population group aged 15-17 in the Total Study Area, a small portion can be expected to seek seating in the two county-wide vocational schools: the Erie County Technical School (ECTS) and the Ashtabula County Joint Vocational School (ACJVS). The expected number of plant-related vocational education pupils (shown in Tables 4-78 and 4-79) is based on the 1975 ratios of vocational pupils to general high school pupils in each school district. The peak total requirement for additional space at each of the two schools is reached between 1987 and 1990, when the Ashtabula County

Table 4-78

Impact-Related Vocational Education Pupils in the Ashtabula County Joint Vocational School -- 1979-1990

	1979	1981	1986	1990
Construction-Related	1	10	5	
Operations-Related	---	10	45	60
Total Impact Pupils	1	20	50	60
Baseline Pupils[1]	850	850	850	850
Total Impact as a Percent of Baseline	*	2%	6%	7%

[1] ACJVS pupils normally attend full-time.

*Less than 0.5%.

Source: Education Services baseline; Education Services Working Paper; SIMPACT IV Model.

Table 4-79

Impact-Related Vocational Education Pupils in the
Erie County Technical School -- 1979-1990

	1979	1981	1986	1990
Construction-Related Pupils	1	15	5	0
Operations-Related Pupils	0	10	30	40
Total Impact Pupils	1	25	35	40
Baseline Pupils[(1)]	400	800	800	800
Total Impact as a Percent of Baseline	*	3%	4%	5%

[(1)] All pupils are enumerated as full-time equivalents. ECTS pupils attend on a half-time basis. Total school enrollment, as full-time equivalents, is 400 prior to 1981. Construction in 1981 is expected to double enrollments.

*Less than 0.5%.

Source: Education Services baseline; Education Services Working Paper; SIMPACT IV Model.

Joint Vocational School would enroll about 60 plant-related pupils and the Erie County Technical School would enroll about 40 full-time equivalent students. These additional seating requirements constitute five percent and seven percent increases over ECTS and ACJVS baseline enrollments at capacity levels (as indicated in Table 4-78 and 4-79). Neither of the two vocational schools is likely to be able to accept additional pupils. Even with the assumed expansion of the ECTS in 1981, baseline pupil demand is expected to fill the additional seats created leaving no seats available for plant-related pupils. The ACJVS has made numerous but unsuccessful attempts to obtain voter approval to expand its facility to meet existing demand; hence, it is assumed that the ACJVS will not expand under baseline conditions.

4.167
In view of the impact of the proposed Lakefront plant, there are several considerations regarding placement of pupils seeking vocational education. These are listed below:

- Each of the two schools could expand its facility to accommodate 45 to 60 plant-related pupils. Under this option, the present baseline ratio of vocational pupils to general high school pupils in the Total Study Area would be maintained. Realistically, however, it cannot be expected that either the ECTS or ACJVS would undertake facility expansion solely to accommodate an additional 45 to 60 vocational education pupils in each service area. Rather, it is more likely that both schools would consider alternative ways to meet vocational education needs in light of their total service areas' educational goals, community attitudes, total pupil demand (existing and impact-related), and financial resources. Neither school, it should be noted, is compelled by law to provide vocational education to a stated proportion of general high school pupils in its service area.

- The additional pupils could be enrolled in general high schools, where their addition would incur lower operating costs than in the more costly vocational schools. However, reducing the number of secondary students with access to vocational education may not be consistent with local educational goals.

- The ECTS could alter its baseline plans to expand in 1981. The addition to the ECTS facility could be constructed larger than presently planned; alternatively, the ECTS could establish a satellite facility in the Pennsylvania Coastal Communities, similar to the ECTS satellite in

Corry, Pennsylvania. Another available option is for ECTS to share a facility with the local school districts.

If the ECTS were to decide to broaden its 1981 expansion program to accommodate the plant-related pupils, the required floor area would be about 8,400 square feet (refer to Table 4-80). The ECTS has a sufficiently large site to permit such expansion. The ACJVS is also not expected to undertake expansion solely to accommodate the plant-related pupils. Further, past failures to have expansion plans for ACJVS approved by the voters render future construction less likely. Without expansion, the plant-related proportion of vocational pupils could enroll in general high schools. Most of these pupils likely would reside in Conneaut City, and if Conneaut high school is expanded, could be accommodated by the additional capacity.

Expenditures

4.168
If the ACJVS were to expand to provide seating for the plant-related pupils, an increase in operating costs amounting to about $2,297 per pupil would be incurred. Paralleling the projected enrollment trends, peak operating costs would occur during 1987-1990 in both schools. During this period the ACJVS and ECTS would incur seven percent and five percent respective increases over baseline operating costs. Capital expenditures for the required additional floor area are based on a construction cost of $58.00 per square foot. Accordingly, the ECTS expansion to provide seating for plant-related vocational pupils would cost about $490,000. The plant-related vocational school costs are shown in Table 4-80.

Staff

4.169
The estimates of staff requirements depend on whether the pupils are enrolled in vocational schools. Should the pupils not be accommodated by the vocational schools, the staff requirements would transfer proportionately to the general high schools serving the seven school districts in the Total Study Area. As pupils to staff ratios for vocational schools are slightly lower than those for the general high schools, the staff requirements, if transferred, may be slightly overestimated. As shown in Table 4-80, the staff requirements are low. In the peak years, 1987 to 1990, ECTS would need about four additional staff personnel while, if the ACJVS were expanded, it would require six employees.

Table 4-80

Impact-Related Vocational Education Cost Requirements -- 1979-1990

Ashtabula County Joint Vocational School	1979	1981	1986	1987	1990
Total Additional Floor Space (sq ft)	200	4,260	9,620	11,880	11,920
Construction Costs (1975 dollars)	---	-	-	-	(1)
Total Staff (full-time equivalents)	---	2	5	5	6
Total Operating Costs (1975 dollars)	$2297	$49,000	$110,600	$136,400	$136,900
Erie County Technical School					
Total Additional Floor Space (sq ft)	200	4,500	7,200	8,300	8,440
Construction Costs[2] (1975 dollars)	---	-	-	-	$490,000
Total Staff (full-time equivalents)	---	2	4	4	4
Total Operating Costs (1975 dollars)	$2267	$51,000	$ 81,800	$ 94,100	$ 95,700

(1) An expansion program at the ACJVS is not expected.

(2) Construction costs @ $58.00/square foot are calculated on basis of maximum space required.

Source: Education Services Working Paper; SIMPACT IV Model.

c) Nonpublic Education

4.170
A small proportion of plant-related school-age population would probably enroll in the nonpublic schools located within the seven public school districts. These students are not expected to have a significant impact on the nonpublic school systems. In 1990, an additional 210 nonpublic pupils resulting from U.S. Steel and associated activities could enroll in the area's nonpublic schools. This would constitute an increase of seven percent over baseline enrollments. Since nonpublic schools are expected to experience declining enrollments under baseline conditions, the schools are assumed to be capable of handling these additional students without expanding their facilities. The expected increase in nonpublic enrollments resulting from the proposed facility and associated development is presented in Table 4-81. In 1981, during construction activity, an additional 95 students would require space in the nonpublic schools in the Total Study Area. These additonal pupils would increase baseline nonpublic enrollments (3,295) by approximately three percent. In 1986, 180 nonpublic pupils would enroll in nonpublic schools; these pupils constitute a six percent increment over baseline nonpublic enrollments. In 1990, the 210 additional nonpublic pupils account for a seven percent increase over baseline nonpublic enrollments. Within the Local Study Area, Conneaut Area City School District would receive most of the plant-related nonpublic pupils (refer to Table 4-81). The St. Francis Cabrini Elementary School would have sufficient capacity (due to declining enrollments) to accommodate nonpublic elementary pupils. The few nonpublic pupils in Northwestern School District could be handled by the nonpublic schools in Conneaut City or in Girard. Similarly, the influx of nonpublic pupils in the principal study area as a whole will not require the expansion of existing facilities with only 110 pupils expected to enroll in nonpublic schools by 1990 (refer to Table 4-81). Most of these would reside in Millcreek and Ashtabula Area City School Districts. Declining nonpublic school enrollments would create sufficient space to handle additional pupils without adverse effects.

Health Care

a) Hospitals

4.171
The magnitude and distribution of the population increase due to the proposed U.S. Steel Lakefront plant and related development are important considerations in determining the impact on hospitals within the Regional Study Area. The magnitude of the population determines the total demand for services while the distribution of the population determines where the services will likely be required.

Table 4-81

Additional Nonpublic Pupils Related to the Proposed Facility and Associated Development -- 1979-1990[1]

School District	1979	1981	1986	1990
Total Study Area	5	95	180	210
Local Study Area	-	20	70	100
Conneaut Area City	-	15	60	85
Northwestern	-	5	10	15
Principal Study Area	5	75	110	110
Buckeye Local	-	5	5	5
Ashtabula Area City	1	30	60	55
Girard	-	10	15	20
Fairview	1	5	5	5
Millcreek	3	25	25	25

(1) Enrollments are full-time equivalent totals of elementary, junior high, and senior high educational levels.

Source: Education Services Working Paper; SIMPACT IV Model.

Since the hospitals in the Regional Study Area now provide medical care principally for residents of certain communities, it is assumed that new residents will adhere to these well-established referral patterns. For the purpose of estimating the impact on individual hospitals, communities have been identified with particular hospitals based on current service areas. Where service areas overlap, a percentage of inpatient utilization was used to allocate the community demand proportionately. For example, Brown Memorial Hospital admitted 2,169 patients from Conneaut in 1976 while Ashtabula General Hospital admitted 710. On the basis of these data, it can be assumed that 75 percent of the new residents in Conneaut will be served at Brown Memorial and 25 percent at Ashtabula General. The Coastal Communities and the hospitals that serve them are listed in Table 4-82. Where a community is served by more than one hospital, it is listed under both hospitals with the percentage distribution appearing in parentheses. All hospitals in Erie City have been listed together since they have similar service areas.

Brown Memorial Hospital (BMH)

4.172
The demand for new health services from BMH will be the sum of the demands from the new plant-related population residing in communities served by BMH: Conneaut (75 percent of incoming population), Kingsville (27 percent of incoming population), and Springfield (75 percent of incoming population). The expected demand for beds at BMH between 1979 and 1990 by community is shown in Table 4-83. By 1979, when current hospital construction work is complete, BMH will have 86 beds (an increase of 11 over the current total of 75 beds). By 1981, seven additional beds are estimated to be needed to serve the new population. This eight percent increase could probably be managed by BMH by increasing occupancy rate, and by planning the number of elective admissions to allow contingency space for emergencies. By 1982, approximately 18 new beds will be needed (18 more than the existing 86 beds), and it is likely that this 21 percent increase could be managed only by new construction. By 1986 and 1987, a total of 26 and 33 new beds, respectively, will be required. The architects have planned the existing BMH structure to accommodate the addition of eight beds to each of five nursing units for a total of 40 beds. (4-1) The estimated cost for this addition would be $1,025,000 (if bids are received by 1 July 1979) plus approximately eight percent inflation for each year construction is delayed. A number of options exist for constructing the additional nursing unit space required including: the addition of eight beds to each of two nursing units (plus foundation floor) to meet the 18-bed need expected for 1982, and then a subsequent two-unit addition on the next two floors to meet the 33-bed demand expected for 1987 and the following years, addition of eight beds to each of four nursing units

Table 4-82

Hospital Service Regions for Primary Care Services

Brown Memorial Hospital

Conneaut, Ohio (75%)[1]

Kingsville, Ohio (27%)[1]

Springfield, Pennsylvania (75%)[1]

Ashtabula General Hospital

Conneaut, Ohio (25%)[1]

Kingsville, Ohio (73%)[1]

Springfield, Pennsylvania (25%)[1]

Ashtabula Township, Ohio

Ashtabula City, Ohio

Other -- Ohio Principal Study Area

Memorial Hospital of Geneva

Saybrook

Erie City Hospitals

Girard, Pennsylvania

Fairview, Pennsylvania

Millcreek, Pennsylvania

Other -- Pennsylvania Principal Study Area

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(1) Hospital assumed to serve indicated percentage of the community population.

Source: Health Care baseline; and Arthur D. Little, Inc.

Table 4-83

Expected Demand[1] for Inpatient Beds at Brown Memorial Hospital -- 1979-1990

Year	75% of Conneaut[2]	27% of Kingsville[2]	75% of Springfield[2]	Other Communities	Cumulative Total Demand
1979	0	0	0	0	0
1980	1	1	1	0	3
1981	4	1	2	0	7
1982	10	1	5	2	18
1983	10	1	5	2	18
1984	10	1	6	2	19
1985	11	1	6	2	20
1986	14	2	8	2	26
1987	18	2	10	3	33
1988	18	2	10	3	33
1989	18	2	10	3	33
1990	18	2	10	3	33

(1) Based on a requirement of 4.7 beds per 1000 incoming population, the current average in the Regional Study Area.

(2) Arthur D. Little, Inc. projections assume that current referral patterns for inpatient care will not change, and thus can be used to estimate where the impact-related population will receive inpatient services. Current patterns show that approximately 75% of Conneaut, 27% of Kingsville, and 75% of Springfield inpatient services are delivered at Brown Memorial Hospital.

Source: Health Care baseline; Health Care Working Paper; SIMPACT IV Model.

(plus foundation floor) at one time, but completion of the interior, and staffing of the units as the demand; addition of the five nursing units to provide for impact-related population as well as to provide contingency space for future expansion for other reasons if BMH believes it necessary. It is expected that the construction costs will approximate $1 million principal plus interest charges for the municipal bond. Operating cost for Brown Memorial in 1976 was $31,140 per bed. The addition of 16 beds by 1982 would increase operating costs by approximately $500,000 (plus inflation) per year. The addition of another 15 beds would add another $450,000 annual operating cost by 1987. Thus, by 1987 $1 million (1976 dollars) will likely be added to annual operating costs.

Ashtabula General Hospital (AGH)

4.173
The demand for new health care services from Ashtabula General Hospital will be the sum of the demands from new population in communities served by AGH, Conneaut (25 percent of the population), Kingsville (73 percent of the population), Springfield (25 percent of the population), Ashtabula Township and Ashtabula City, and other communities south of Ashtabula City. The expected demand for inpatient beds at AGH between 1979 and 1990 is shown in Table 4-84. By 1981, an additional 12 beds are estimated to be needed to serve new population above the current bed count of 235. This five percent increased demand can probably be managed without new construction by increasing occupancy rate, by planning the number of elective admissions to allow contingency space for emergencies, and by adding another bed to each of the six larger single rooms that meet hospital architectural standards for two-bed rooms. By 1985, the need will have increased to above 20 beds (eight percent increase), and by 1987, 29 beds (13 percent) and the construction of more bed capacity will be required. The current AGH structure allows for the addition of a 30-bed nursing unit over the North Wing. The approximate cost of this North Wing addition is $628,000 at current dollars plus interest. Operating cost for AGH in 1976 was $30,600 per bed. The addition of 30 beds would increase operating cost by approximately $918,000 per year at 1976 dollars.

Memorial Hospital of Geneva (MHG)

4.174
The need for additional health care services arising from plant-related new population at MHG is expected to be quite small. Since MHG admits a small number of inpatients from communities where the new population may settle, it is anticipated that an increased demand of one or two beds will likely be managed with current facilities and staff.

Table 4-84

Expected Demand[1] for Inpatient Beds at Ashtabula General Hospital -- 1979-1990

Year	25% of Conneaut[2]	73% of Kingsville[2]	25% of Springfield[2]	Ashtabula Township	Ashtabula City	Ohio Other Communities	Cumu-lative Total
1979	0	0	0	0	0	0	0
1980	0	1	0	0	2	2	5
1981	1	3	0	2	3	3	12
1982	3	3	2	4	3	3	18
1983	3	3	2	4	2	2	16
1984	4	3	2	5	2	2	18
1985	4	3	2	6	3	3	21
1986	5	4	3	7	4	4	27
1987	6	4	3	8	4	4	29
1988	6	4	3	8	4	4	29
1989	6	4	3	8	4	4	29
1990	6	4	3	8	4	4	29

(1) Based on a requirement of 4.7 beds per 1000 incoming population, the current average in the Regional Study Area.

(2) Arthur D. Little, Inc. projections assume that current referral patterns for impatient care will not change, and thus be used to estimate where the impact-related population will receive inpatient services. Current patterns show that approximately 25% of Conneaut, 73% of Kingsville, and 25% of Springfield inpatient services are delivered at Ashtabula General Hospital.

Source: Health Care baseline; Health Care Working Paper, SIMPACT IV Model.

Erie Hospitals

4.175
The demand for additional beds at Erie County hospitals created by plant-related populations in the townships of Girard, Fairview, Millcreek, and other Pennsylvania communities is shown in Table 4-85. The peak demand of 16 beds in 1981 and 17 beds in 1986 will have a small one percent impact on the 1,574 beds currently in Erie County, no matter how this new demand is distributed. Referrals to the Erie hospitals due to the new population in Ohio are not expected to increase this demand significantly.

b) Long-Term Care

4.176
It is anticipated that very few people over 65 years of age will move into the Regional Study Area due to U.S. Steel and related development and by 1990, only a small percentage of the new population will have reached age 65. Therefore, this increase in population may not have a significant effect on long-term care facilities; however, there may be an indirect effect. Generally, hospitals discharge a number of patients directly to nursing homes. Occasionally, these patients must wait in the hospital for a bed to become available in a nursing home, especially if the patient is receiving Medicare. New hospital construction will probably not occur until present beds are utilized at a higher rate. During this period of greater demand for the available beds, it will probably be necessary to discharge patients as soon as possible. The availability of more nursing home beds, especially Medicare-approved beds, will help alleviate some demand for inpatient beds.

c) Manpower

Physicians

4.177
In Ashtabula County, hospitals are the focus of most of the primary care delivery. Physicians usually affiliate themselves with one hospital and arrange admitting privileges with that hospital so that they may admit and treat their patients there. Most physicians that have opened a practice in the study communities within the last couple of years have been actively recruited by hospitals. The physicians focus their practice at the hospitals and admit nearly all of their patients to the hospital with which they are affiliated (except, of course, in emergencies). These relationships control the referral patterns and the service areas of the hospitals. Since it is likely that the hospitals will continue recruiting to attract new physicians to meet baseline or impact-related population increases,

Table 4-85

Expected Demand[1] for Inpatient Beds at Erie County Hospitals -- 1979-1990

Year	Girard	Fairview	Millcreek	Pennsylvania Other Communities	Cumulative Total
1979	0	0	0	0	0
1980	1	1	3	3	8
1981	2	3	5	6	16
1982	3	2	2	4	11
1983	3	2	1	2	8
1984	4	2	1	2	9
1985	4	3	2	4	13
1986	5	3	4	5	17
1987	6	3	3	4	16
1988	6	2	2	4	14
1989	6	2	2	4	14
1990	6	3	2	4	15

(1) Based on a requirement of 4.7 beds per 1000 incoming population, the current average in the Regional Study Area.

Source: Health Care baseline; Health Care Working Paper; SIMPACT IV Model.

the same referral patterns will be utilized. The requirements for new physicians for the populations to be served by Brown Memorial Hospital, Ashtabula General Hospital, and the Erie hospitals, assuming the current ratio of physicians to population is to be maintained, is shown in Table 4-86. Memorial Hospital of Geneva will not need to add any physicians to its staff. It is anticipated that approximately nine physicians will need to be recruited by Brown Memorial by 1990, 11 by Ashtabula General, and five by all Erie hospitals combined. If Brown Memorial and Ashtabula General each recruited one physician per year on the average, these needs would be met. Such a recruitment should not be difficult to maintain in view of the comprehensive medical coverage programs provided to employees of the U.S. Steel Corporation. In Erie County, the addition of five physicians would have very little impact on current patterns of health care delivery unless these physicians settle in rural areas where there is currently a shortage of physicians, or unless they possess specialties that are needed in that area. Since there is a shortage of professional office space in the communities surrounding Ashtabula General and Brown Memorial and there is limited office space available at the hospitals, it is likely that such facilities will be constructed.

Dentists

4.178
Dentists will not necessarily be affiliated with the existing hospitals, but instead, tend to develop independent and small group practices. The demand for dentists for both Ohio and Pennsylvania assuming the current ratio of dentists to population presented in Table 4-87. The number of additional dentists required is expected to be small. Approximately eight more dentists are estimated to be required by 1990 for the Regional Study Area, five attributed to Ohio and three attributed to Pennsylvania population. Since the ratio of dentists to population in the Regional Study Area is comparable to statewide levels, and since U.S. Steel provides comprehensive dental coverage for employees, it is likely that these demands will be met readily without having to actively recruit dentists.

Law Enforcement

4.179
The initial estimates of impacts on law enforcement services in the Principal Study Area were based on the assumption that police protection in each of the Coastal Communities will be provided entirely by local departments throughout the projection period. Each of the Coastal Communities currently has, or is projected to have under baseline conditions, a population large enough to support a local police department. However, several jurisdictions in the area which

Table 4-86

Number of Additional Physicians Needed to Meet Demand(1) of New Population -- 1979-1990

Year	Brown Memorial Hospital	Ashtabula General Hospital	Erie Hospitals
1979	0	0	0
1980	1	3	2
1981	2	6	4
1982	5	7	4
1983	5	7	4
1984	5	7	4
1985	6	8	4
1986	7	11	5
1987	9	11	5
1988	9	11	5
1989	9	11	5
1990	9	11	5

(1) Based on a requirement of 1.5 physicians per 1000 incoming population, the current average in the Regional Study Area.

Source: Health Care baseline; Health Care Working Paper; SIMPACT IV Model.

Table 4-87

Number of Additional Dentists Needed to Meet Demand of New Population -- 1979-1990

Year	Ohio	Pennsylvania
1979	0	0
1980	1	1
1981	2	2
1982	3	2
1983	3	2
1984	3	2
1985	3	2
1986	4	3
1987	5	3
1988	5	3
1989	5	3
1990	5	3

Source: Health Care baseline; Health Care Working Paper; SIMPACT IV Model.

already have relatively large populations are currently without local police departments and receive police services from the Ashtabula County Sheriff's Department or the Pennsylvania State Police. Population size is not the only factor determining if or when a local police force will be established. Costs and community preferences must also be taken into consideration. It is therefore likely that one or all of the jurisdictions without local law enforcement would continue to rely on County Sheriff or State Police services.

4.180
In order to provide the most realistic range of possible impacts, two law enforcement service alternatives have been developed: Local Law Enforcement Alternative - in which all police services in the Coastal Communities are provided by local departments, or Existing Conditions Alternative - in which those communities which currently receive service from the Ashtabula County Sheriff's Department or Pennsylvania State Police will continue to do so.

4.181
There is one exception in the Existing Conditions Alternative. Although there is currently no local police department in Springfield, it has been assumed that one will be established should the proposed facility be built. Such a move is already under discussion by township authorities. In addition, activity related to the proposed plant is expected to increase Springfield's population by approximately 70 percent by 1990. Moreover, traffic in and around Springfield should also increase significantly during both the construction and operation of the proposed plant. Revenues accruing to the local Government from the plant and related development will be sufficient to cover the costs of police department development. Therefore, it is expected that Springfield would provide its own law enforcement services under either alternative. Based on current plans, the new police department will most likely be created for Springfield Township only. However, police requirements for East Springfield Borough have been included as part of the total Springfield police services. In reality, joint police protection for East Springfield could be provided by the Springfield Township force under a contract arrangement the same way that fire protection is currently provided for both communities by a single department. The population of the borough is so small that including it under the jurisdiction of the new department would not make a significant difference in total requirements for the Springfield area.

4.182
The Existing Conditions Alternative is the most likely scenario for future law enforcement service provision in the Principal Study Area. Even though most of the communities without local police departments presently have populations much larger than the threshold size

defined in the Law Enforcement Working Paper (which was appended to the draft EIS), protection is still provided by county or State police. It is not expected that the relatively small population growth induced by the proposed plant would provide sufficient impetus to change the present system of police protection in those communities. In addition, the costs associated with establishing a local police department are substantial. For example, Saybrook Township would need to spend approximately $250,000 for police facilities and another $200,000 in operating costs to provide local police services for the 1990 baseline population. However, the township would receive relatively little additional tax revenue if the plant is built. Therefore, provision of local law enforcement services could require an increase in the local property tax rate. The distribution of police services in the Coastal Communities expected under the Existing Conditions Alternative throughout the projection period is shown in Table 4-88. Police protection is expected to be provided completely at the local level in Conneaut, Ashtabula City, Springfield, and Millcreek Township. There would be no local level law enforcement in Ashtabula and Saybrook Townships. The remaining three communities (Kingsville, Girard, and Fairview) would have some local police protection with the remainder provided at the county/State level. The existing police departments in these communities are in North Kingsville Village, Girard Borough, Lake City Borough, and Fairview Borough. Kingsville Township, Girard Township, Platea Borough, and Fairview Township are without local police protection.

4.183
In order to estimate the magnitude of impact under each alternative, two sets of baseline projections were required. The projections developed in the Law Enforcement baseline section were made only for currently existing departments and a possible new department in Springfield, PA. Thus, the baseline is applicable for the Existing Conditions Alternative scenario discussed in this section. However, if a new department is established in a community which currently receives protection from the County Sheriff or State Police, local police services will be required for the population expected without the proposed plant in addition to any plant-related increases. These estimates have been used as the baseline for the Local Law Enforcement Alternative. In summary, the baseline requirements shown under the existing conditions alternative are projections for existing departments only, while the baseline requirements associated with the Local Law Enforcement Alternative represent the expected level of service for each Coastal Community's total projected baseline population. It should be noted that there are many possible combinations for providing police protection between the extremes of local departments in each of the Coastal Communities and existing conditions. Thus, it is not possible to predict the option that will

Table 4-88

Distribution of Law Enforcement
Services--Existing Conditions Alternative

	Percent of Population Receiving	
	Local Police Service	County/State Police Service
Local Study Area		
Conneaut	100%	-
Springfield	100	-
Ohio Principal Study Area		
Kingsville	50	50
Ashtabula Township	-	100
Ashtabula City	100	-
Saybrook Township	-	100
Pennsylvania Principal Study Area		
Girard Area	67	33
Fairview	25	75
Millcreek	100	-

Source: Law Enforcement Working Paper.

be selected by each jurisdiction. In general, however, the Local Law Enforcement Alternative represents the greatest impact on local police services, while the Existing Conditions Alternative is the case of least impact. The relative magnitude of impacts is reversed for the areawide forces under each alternative. If local departments are not established in communities currently without such service, the responsibility for law enforcement in these areas will continue to be borne by the Ashtabula County Sheriff's Department and the Pennsylvania State Police. Therefore, the Existing Conditions Alternative describes the greatest impact on the areawide forces and the Local Law Enforcement Alternative the least.

a) Manpower

Local Study Area

Conneaut

4.184
The Conneaut Police Department currently employs 21 full-time police officers and two civilian dispatchers. Baseline projections indicate additional police requirements of one full-time police position by 1981, one more by 1986, and a third by 1990, raising the total number of police employees to 26 by that year. With the development of the proposed plant, two additional police officers would be required in Conneaut by 1981 (approximately eight percent above projected baseline police employment). In 1986, the new population would require a 28 percent increase over baseline police employment, or seven additional personnel. By 1990, when the new population has reached its maximum impact, the Conneaut Police Department would require an additional nine employees over its projected baseline of 26, an increase of almost 35 percent (refer to Table 4-89). Since construction of the plant is expected to be completed in 1987, there would be no construction-related impact in 1990.

Springfield

4.185
Springfield currently has no local police force. Police services are provided by the Pennsylvania State Police. However, as discussed in the Law Enforcement baseline section, the population of Springfield Township and the Borough of East Springfield is large enough to support a local police department. Baseline projections indicate a local force of three officers would now be required in the area, increasing to four officers by 1990. If the proposed plant is built, it is likely that a local police department will be established in Springfield. In 1981, the year of peak construction activity and operations start-up, one additional police officer would be required

Table 4-89

Law Enforcement Personnel Requirements in the Local Study Area -- 1979-1990

	1979	1981	1986	1990
Conneaut				
Construction-Related	0	1	1	0
Operations-Related	0	1	6	9
Total Impact	0	2	7	9
Baseline	24	24	25	26
Total Impact as a Percent of Baseline	-	8%	28%	35%
Springfield				
Construction-Related	0	0	0	0
Operations-Related	0	1	4	5
Total Impact	0	1	4	5
Baseline(1)	3	3	4	4
Total Impact as a Percent of Baseline	-	33%	100%	125%

(1) Number of local police required at rate of 1 per 1000 population

Source: Law Enforcement baseline; Law Enforcement Working Paper; SIMPACT IV Model.

(refer to Table 4-74). In 1986, the plant-related new population would generate a requirement for four police personnel, in addition to the four required under baseline projections. By 1990, the impact on police requirements would be five employees, more than doubling the size of the anticipated baseline police force. The increase in police manpower requirements in Springfield is considerably larger than the expected population increase. However, per capita police personnel levels in the Regional Study Area are generally lower than the national average. Therefore, it has been assumed that as population in each community increases, the level of law enforcement service will gradually approach the national average level. Thus, the plant-related increase in police manpower requirements reflects not only the increase in population but also a more comprehensive level of service than under baseline conditions. The impacts on law enforcement services in Local Study Area identified above are those associated with the new resident population. In addition to these, there will be demands for police services created by workers driving to and from the proposed plant site. State agencies (the Ohio Highway Patrol and Pennsylvania State Police) are expected to provide most traffic-related services on the major highways in the area, although the Conneaut Police Department has recently assumed patrol responsibilities for the portion of I-90 passing through the city. However, additional traffic on local roads (particularly near the plant entrance gates) would likely require some additional manpower or reassignment of officers from police departments in Conneaut and Springfield.

Ohio Principal Study Area

4.186
There are currently two local police departments in the Ohio Coastal Communities, North Kingsville Village, and Ashtabula City. All other parts of the Coastal Communities have police services provided by the Ashtabula County Sheriff's Department.

Existing Conditions Alternative

4.187
Under this alternative, plant-related new population would generate a need for only two additional local police officers in the Coastal Communities in 1981, 1986, and 1990, one each in North Kingsville Village and Ashtabula City. This would increase total local police employment by approximately four percent over projected baseline levels. The Sheriff's Department would require three additional deputies in 1981, four in 1986, and four in 1990 as shown in Table 4-90. The plant-related new population would create a need for one additional officer on the North Kingsville Village police force during the 1981-90 period while law enforcement services in

Table 4-90

Law Enforcement Personnel Requirements in the Ohio Principal Study Area and Key Coastal Communities -- 1975-1990

	Existing Conditions Scenario				Local Law Enforcement Scenario			
	1979	1981	1986	1990	1979	1981	1986	1990
Kingsville								
Construction-related	0	1	0	0	0	1	1	0
Operations-related	0	0	1	1	0	1	1	2
Total Impact	0	1	1	1	0	2	2	2
Baseline	5	5	6	7	8	9	10	11
Total Impact as a Percent of Baseline	-	20%	17%	14%	-	22%	20%	18%
Ashtabula Township								
Construction-related	0	0	0	0	0	1	0	0
Operations-related	0	0	0	0	0	0	2	3
Total Impact	0	0	0	0	0	1	2	3
Baseline	0	0	0	0	13	13	13	14
Total Impact as a Percent of Baseline	-	-	-	-	-	8%	15%	21%
Ashtabula City								
Construction-related	0	1	0	0	0	1	0	0
Operations-related	0	0	1	1	0	0	1	1
Total Impact	0	1	1	1	0	1	1	1
Baseline	41	41	41	41	41	41	41	41
Total Impact as a Percent of Baseline	-	2%	2%	2%	-	2%	2%	2%
Saybrook Township								
Construction-related	0	0	0	0	0	1	0	0
Operations-related	0	0	0	0	0	0	1	0
Total Impact	0	0	0	0	0	1	1	0
Baseline	0	0	0	0	12	12	13	14
Total Impact as a Percent of Baseline	-	-	-	-	-	8%	8%	-
Ashtabula County Sheriff's Department								
Construction-related	0	2	1	0	0	1	0	0
Operations-related	0	1	3	4	0	0	1	1
Total Impact	0	3	4	4	0	1	1	1
Baseline	60	61	63	65	60	61	63	65
Total Impact as a Percent of Baseline	-	5%	6%	6%	-	2%	2%	2%

Source: Law Enforcement baseline; Law Enforcement Working Paper; SIMPACT IV Model.

Kingsville Township would continue to be provided by the Ashtabula County Sheriff's Department. Ashtabula City currently has the largest local police force in Ashtabula County. Although baseline population is expected to decline, police employment is expected to remain at the authorized level of 41 officers and civilian personnel throughout the projection period. Only one additional officer would be required as a result of the new resident population in 1981-1990, an increase of only two percent. However, since the city's population is projected to decline even with development of the proposed plant, it is possible that this additional position might not need to be filled. Neither Ashtabula nor Saybrook Township would have a local police department under the Existing Conditions Alternative; therefore, there would be no impact associated with the proposed plant. Both communities would continue to receive all police services from the County Sheriff's Department. The only other local police departments in the Ohio Principal Study Area are in Jefferson and Andover. It is expected that plant-related population growth outside the Coastal Communities would not be large enough nor sufficiently concentrated to have any measurable impact on these departments. The Ashtabula County Sheriff's Department provides law enforcement services to all areas of the county without local police services. There are currently 57 officers and civilian personnel in the department. Baseline projections indicate total employment of 60 personnel by 1979 and 65 by 1990. Even under the Existing Conditions Alternative, which would represent the greatest impact on the Sheriff's Department, the overall magnitude of employment increases would be small. The addition of deputies to serve the new resident population throughout the county would increase the size of the force to 64 in 1981, 67 in 1986, and 69 by 1990, increases of approximately five percent, six percent, and six percent, respectively.

<u>Local Law Enforcement Alternative</u>

4.188
Under the Local Law Enforcement Alternative, total plant-related local police employment would be five officers in 1981, six in 1986, and six in 1990. This would represent approximately seven percent of projected baseline local police employment in all of the Coastal Communities in 1981 and approximately eight percent in 1986 and 1990. However, the largest increases in police employment would result from the manpower requirements of three entirely new departments. Only one additional sheriff's deputy would be needed in 1980. With local law enforcement in Kingsville, two plant-related officers would be needed from 1981 to the end of the projection period, one each for the North Kingsville Village Police Department and the new department in Kingsville Township. The new department would have a baseline employment of three officers in 1979 and four in 1981 and the following years. Creation of a local police department in Ashtabula

Township would require 13 personnel during the 1979-86 period and 14 by 1990 to serve the projected baseline population. The plant-related impact would be one additional officer in 1981, two in 1986, and three by 1990. This would be an increase of approximately 20 percent over baseline employment by 1990. Utilizing local law enforcement in Saybrook Township, the projected baseline population would require a force of 12 employees in 1979 and 1981, increasing to 13 in 1986 and 14 by 1990. The small population increase associated with the proposed plant would require one additional officer in 1981 and 1986 (an increase of eight percent). There would be no construction-related impact in 1990. The operations-related population in 1990 would not be large enough to create a requirement for additional police employment. Impacts on law enforcement employment in Ashtabula City under this alternative are the same as those described for the Existing Conditions Alternative. Under the Local Law Enforcement Alternative, the impact on the County Sheriff's Department associated with the proposed plant would be minimal, one additional deputy in 1981, 1986, and 1990. This would represent an increase of less than two percent over baseline employment. Furthermore, the baseline projection of the future number of personnel required was based on the assumption that the Sheriff's Department would continue to serve all areas of the county without currently existing police forces. Therefore, under this alternative, there might be no need to increase the number of deputies in response to plant-related population increases.

Pennsylvania Principal Study Area

4.189
In the Pennsylvania Coastal Communities there are currently local police departments in the Girard and Lake City Boroughs, Fairview Borough, and Millcreek Township. Girard Township, Platea Borough, and Fairview Township receive law enforcement services from the Pennsylvania State Police.

4.190
Under the Existing Conditions Alternative, plant-related local police employment in the Pennsylvania Coastal Communities would be three officers in 1981 and only two in 1986 and 1990, due to a decreased requirement in Millcreek Township. This would increase total police employment in the existing departments in the Girard Area and Millcreek by four percent in 1981 and approximately two percent in 1986 and 1990, a very minor impact. State police employment would need to be increased by two officers above baseline projections in the 1981-1990 period to serve the new resident population (refer to Table 4-91). The two local police departments in the Girard Area are projected to have a baseline employment level of 11 personnel throughout the projection period. Plant-related new population would

Table 4-91

Law Enforcement Personnel Requirements in the Pennsylvania Principal Study Area and Key Coastal Communities -- 1975-1990

	Existing Conditions Scenario				Local Law Enforcement Scenario			
	1979	1981	1986	1990	1979	1981	1986	1990
Girard Area								
Construction-related	0	1	0	0	0	1	0	0
Operations-related	0	0	1	1	0	0	2	2
Total Impact	0	1	1	1	0	1	2	2
Baseline	11	11	11	11	15	15	17	18
Total Impact as a Percent of Baseline	-	9%	9%	9%	-	7%	12%	11%
Fairview								
Construction-related	0	0	0	0	0	1	0	0
Operations-related	0	0	0	0	0	0	1	1
Total Impact	0	0	0	0	0	1	1	1
Baseline	2	2	3	4	9	10	11	11
Total Impact as a Percent of Baseline	-	-	-	-	-	10%	9%	9%
Millcreek Township								
Construction-related	0	2	1	0	0	2	1	0
Operations-related	0	0	0	1	0	0	0	1
Total Impact	0	2	1	1	0	2	1	1
Baseline	61	63	69	73	61	63	69	73
Total Impact as a Percent of Baseline	-	3%	1%	1%	-	3%	1%	1%
Pennsylvania State Policy (Girard Sub-station)								
Construction-related	0	2	1	0	0	1	1	0
Operations-related	0	0	1	2	0	0	0	1
Total Impact	0	2	2	2	0	1	1	1
Baseline	31	34	38	42	31	34	38	42
Total Impact as a Percent of Baseline	-	6%	5%	5%	-	3%	3%	2%

Source: Law Enforcement baseline; Law Enforcement Working Paper; STMPACT IV Model.

generate a requirement for one additional officer in 1981-1990, an increase of approximately nine percent. The portion of the plant-related population expected to receive local police services in Fairview would be so small that no additional employees would be needed on the Fairview Borough Department; therefore the proposed plant would have no measurable impact on police employment in Fairview. Millcreek Township has the largest local police department in the Pennsylvania Coastal Communities. Impacts related to the proposed plant would be relatively minor with two additional officers needed in 1981 and only one in 1986 and 1990. This decreasing requirement is due to the large number of construction workers (both movers and weeklies) expected to live in Millcreek. The largest overall population impact would occur in 1981 and would thus create the greatest law enforcement employment impact in that year. However, since there is expected to be a substantial increase in the size of the police force even without the proposed plant, the actual effect of the construction-related impact would be the hiring of one additional employee a year or two earlier than would be required under baseline conditions. The other local police departments in the Pennsylvania Principal Study Area, Erie City, Albion Borough, Edinboro, Conneautville, and Linesville, are likely to experience virtually no measurable impact from either construction or operation of the proposed facility. The Pennsylvania State Police provide law enforcement services to all unincorporated areas of Erie and Crawford counties and to incorporated areas without local police forces. Under the Existing Conditions Alternative, only two additional officers would be needed in 1981 and the following years, an increase of approximately five percent over baseline employment.

LOCAL LAW ENFORCEMENT ALTERNATIVE

4.191
Under this alternative, the plant-related impact on existing and new local police departments in the Pennsylvania Coastal Communities would be four officers during the 1981-1990 period. With the addition of 14 local police personnel by 1990 to serve projected baseline population in communities without existing local departments, the plant-related impact would be approximately four percent over total baseline employment. Only one additional officer would be needed at the State Police substation from 1981 through the end of the projection period. With local law enforcement, the number of police employees required to serve the projected baseline population of all communities in the Girard Area would be 15 in 1979 and 1981, 17 in 1986, and 18 in 1990, compared to 11 in all years under the Existing Conditions Alternative. Additional local police employment due to the proposed facility would be one officer in 1981 and two in 1986 and 1990. With a local police department in Fairview Township, total baseline employment for the township and borough would be nine personnel in 1979, 10 in 1981, and 11 in 1986 and 1990. In this case,

plant-related new population would generate a demand for one additional police officer in 1981 and the following years, most probably assigned to the Fairview Township force. Plant-related impacts on police employment in Millcreek Township under this alternative would be the same as those described for the Existing Conditions Alternative. In terms of the local law enforcement scenario, the impact of the proposed plant on personnel requirements for the State Police would be approximately three percent over the baseline employment level in the 1981-1990 period. Furthermore, as discussed above for the Ashtabula County Sheriff's Department, the additional position might not need to be filled if new local departments are created in communities currently receiving State Police protection.

b) Facility Requirements

.192

Requirements for additional police facilities are discussed in terms of portions of a "typical" police station (a definition of this term is presented in the Law Enforcement Working Paper which was appended to the draft EIS. It should be noted that this space could be provided in several ways. If construction of less than one police station were needed in a given community, space could be provided by construction of a smaller-than-average police substation. Alternatively, a relatively small requirement for additional space could be met by modification of or additions to existing facilities. Similarly, if more than one police station were needed, the necessary space could be provided by construction of a larger-than-average station or a combination of a new "typical" facility and expansion of an existing one. The actual configuration of any new facilities would have to be determined by each individual jurisdiction. Except in the Local Study Area, it is not likely that there would be any local police facility construction. The facility requirement associated with each new officer is based on the average per employee space proportion of a police station. This includes communications center, detention cells, and other support services in addition to each officer's working area. The facility "construction" associated with a single additional officer would most likely be limited to the installation of a partition or an extra desk in the squad room.

Local Study Area

Conneaut

4.193

The addition of nine employees to the Conneaut police force by 1990 would require the construction of 0.4 police stations (approximately 2,500 square ft.). While all of this space would not be required until the end of the projection period, it is expected that construction would occur in 1981 since some additional space would be needed by 1982. Construction of this space would cost approximately $95,000

and require 1.8 man-years of labor (refer to Table 4-92). The Conneaut Police Department considers its present space in City Hall inadequate. A proposal to move police headquarters to another location in the city is currently under consideration. It is possible that the additional facility requirements associated with the proposed plant would provide the impetus for construction of this new station. Combining baseline and impact requirements, 1.4 "typical" facilities (8,400 sq. ft.) would be needed at a total construction cost of approximately $345,000. Some 30 percent of the new construction would be directly related to the proposed project.

Springfield

4.194
Creation of a local police department in Springfield would require completely new facility construction since there is no existing police station. The five employees required by plant-related population by 1990 would require 0.5 police stations (2,100 sq. ft.). In addition, another 0.4 stations would be required for the projected baseline police force. Overall, a station of approximately 4,000 sq. ft. (0.9 stations) would be required in Springfield to meet police facility requirements through the end of the projection period. It is anticipated that this station would be built as soon as the decision was reached to create a local department, probably in 1980. The construction cost for this facility would be approximately $155,000, of which 55 percent would be directly related to the impact of the proposed plant.

Ohio Principal Study Area

EXISTING CONDITIONS ALTERNATIVE

4.195
Under the Existing Conditions Alternative there would most likely be no need for additional local police facilities in the Ohio Coastal Communities. It is probable that there would be no difficulty accommodating the one additional officer expected for North Kingsville Village and Ashtabula City police forces in the existing facilities (refer to Table 4-93). In addition, it is possible that the position in Ashtabula City might not be filled because of declining baseline population. Under the Existing Conditions Alternative, the equivalent of 0.4 new stations (approximately 1,700 sq. ft.) would be needed by the Ashtabula County Sheriff's Department to provide accommodations for the four plant-related deputies. The required expenditure for this construction is estimated at $70,000. As discussed above, it is likely that these figures overstate the actual facility needs associated with a small increase in employment. However, it is probable that any space required for additional deputies would be provided in conjunction with the construction of the proposed new county jail and justice center in Jefferson.

Table 4-92

Local Police Facilities Requirements in the Local Study Area

<u>Conneaut</u>	
Number of Facilities Required	0.4
Estimated Year of Construction	1981
Construction Cost ($1975)	$90,000
Construction Labor (man-years)	1.8
<u>Springfield</u>	
Impact	
Number of Facilities Required	0.5
Estimated Year of Construction	1980
Construction Cost ($1975)	$85,000
Construction Labor (man-years)	1.6
Baseline	
Number of Facilities Required	0.4
Estimated Year of Construction	1980
Construction Cost ($1975)	$70,000
Construction Labor	1.4

Source: Law Envorcement baseline; Law Enforcement Working Paper; SIMPACT IV Model.

Table 4-93

Police Facility Requirements in the Ohio Principal Study Area and Key Coastal Communities (Construction Costs in 1975 Dollars)

	Existing Conditions Scenario	Local Law Enforcement Scenario
Kingsville		
Impact		
Number of Facilities	0.1	0.2
Construction Cost	$20,000	$35,000
Construction Labor (man-years)	0.3	0.7
Baseline		
Number of Facilities	-	0.4
Construction Cost	-	$70
Construction Labor (man-years)	-	1.4
Expected Year of Construction	1980	1980
Ashtabula Township		
Impact		
Number of Facilities	0.0	0.3
Construction Cost	0.0	$50,000
Construction Labor (man-years)	0.0	0.9
Baseline		
Number of Facilities	0.0	1.4
Construction Cost	0.0	$250
Construction Labor (man-years)	0.0	4.8
Expected Year of Construction	-	1981
Ashtabula City (Impact only)		
Number of Facilities	0.0 (1)	0.0 (1)
Construction Cost	$10,000	$10,000
Construction Labor (man-years)	0.2	0.2
Expected Year of Construction	-	-
Saybrook Township		
Impact		
Number of Facilities	0.0	0.0 (1)
Construction Cost	0.0	$10,000
Construction Labor (man-years)	0.0	0.2
Baseline		
Number of Facilities	0.0	1.4
Construction Cost	0.0	$250,000
Construction Labor (man-years)	0.0	4.8
Expected Year of Construction	-	1980
Ashtabula County Sheriff's Department (Impact only)		
Number of Facilities	0.4	0.1
Construction Cost	$70,000	$20,000
Construction Labor (man-years)	1.4	0.4
Expected Year of Construction	1979	1979

(1) Less than 0.5%.

Source: Law Enforcement baseline; Law Enforcement Working Paper; SIMPACT IV Model.

Local Law Enforcement Alternative

4.196
Under the Local Law Enforcement Alternative, a fairly significant amount of facility construction would be required in the Coastal Communities, but most of it would be associated with baseline requirements, that is, building new police stations in communities without currently existing departments. A new department in Kingsville Township would have a baseline facility requirement of 0.4 stations (approximately 1,700 sq. ft.) with an associated construction cost of $70,000. The incremental U.S. Steel plant-related impact would be 0.2 stations costing $35,000. However, as can be seen in Table 4-93, half of this impact would be associated with the existing North Kingsville Village Police Department. Therefore, the total facility requirement under local law enforcement in Kingsville Township would be approximately 0.5 stations, of which 20 percent would be the plant-related impact. Neither Ashtabula nor Saybrook Township currently has a local police department or police station. Baseline facility requirements in both communities under the Local Law Enforcement Alternative would be the same with 1.4 stations (6,000 sq. ft.) to be built at a cost of $250,000 each. In Ashtabula Township, the additional facility requirement associated with the proposed plant would be 0.3 stations (1,300 sq. ft.) at a cost of 50,000 or approximately 20 percent over the expected baseline construction requirements. There would be no significant incremental impact on police facility requirements in Saybrook since the $10,000 construction cost shown in Table 4-93 would represent only a four percent increase over the projected baseline construction cost. Under local law enforcement, the additional facility requirement for the Sheriff's Department attributable to the proposed plant would be approximately 400 square feet (0.1 station) with an associated cost of some $20,000, although it is unlikely that this expansion would actually be built.

Pennsylvania Principal Study Area

Existing Conditions Alternative

4.197
As discussed above for the Ohio Principal Study Area, it is also probable that there would be no need for local police facility construction in the Pennsylvania Coastal Communities under the Existing Conditions Alternative. The one additional officer required in the Girard Area would most likely be accommodated in an existing facility. Similarly, it is most likely that the existing facilities of the Millcreek Police Department are sufficient to accommodate the two additional officers required by proposed plant development without any additional construction or the expenditure of the $15,000 shown

in Table 4-94. It is possible that police station construction might be needed in Millcreek because of expected baseline employment increases (12 personnel) not related to the U.S. Steel Lakefront Plant proposal.

Local Law Enforcement Alternative

4.198
Under the Local Law Enforcement Alternative, most local police station construction would be associated with baseline requirements. New departments in the Girard Area and Fairview Township would each require the equivalent of 0.7 stations (approximately 3,000 sq. ft.) at a cost of some $125,000. The incremental impact would be 0.1 station in each community, increasing facility requirements and costs approximately 14 percent over baseline projections (refer to Table 4-94). Although the total impact in the Girard Area is 0.2 stations, half of this requirement would be associated with existing police stations. Thus it is probably that additional facility construction will not occur. Additional facility requirements for the Pennsylvania State Police associated with the proposed plant would be minor under either alternative. With existing conditions, the plant-related new officers would require the equivalent of 0.2 stations at a cost of $35,000. Under the Local Law Enforcement Alternative, the number of stations needed would decrease to 0.1 and the construction cost to $25,000. Again, it is not likely that there would actually be a need to expand the existing substation to accommodate one or two additional officers.

Equipment Requirements

4.199
In addition to expanded or new facilities for police personnel, expenditures will be required for patrol vehicles for new officers. Although the projected operating expenses include provisions for maintenance and periodic replacement of existing vehicles, the original purchase of new police cars may represent a fairly substantial expense in communities expected to employ several new officers. The estimated requirement for police vehicles is one car for every 2.5 officers, to be purchased at a cost (1975 dollars) of approximately $6,000. In jurisdictions expected to require only a few local police officers due to proposed plant development, the impact of the cost of additional vehicles would be minor. For example, in Conneaut one vehicle would be needed in 1981, two more by 1986, and a fourth by 1990, for a total equipment expenditure of $24,000 over a nine-year period. However, if a community were to establish an entirely new force under the local law enforcement alternative, the purchase of vehicles would add substantially to expected baseline facility costs. For example, a new force of 13 personnel in Ashtabula Township would

Table 4-94

Police Facility Requirements in the Pennsylvania Principal Study Area and Key Coastal Communities (Construction Costs in 1975 Dollars)

	Existing Conditions Scenario	Local Law Enforcement Scenario
Girard Area		
Impact		
Number of Facilities	0.1	0.2
Construction Cost	$20,000	$35,000
Construction Labor (man-years)	0.3	0.7
Baseline		
Number of Facilities	-	0.7
Construction Cost	-	$125,000
Construction Labor (man-years)	-	2.4
Expected Year of Construction	1981	1981
Fairview		
Impact		
Number of Facilities	0.0	0.1
Construction Cost	0.0	$20,000
Construction Labor (man-years)	0.0	0.4
Baseline		
Number of Facilities	-	0.7
Construction Cost	-	$125
Construction Labor (man-years)	-	2.4
Expected Year of Construction	-	1979
Millcreek (impact only)		
Number of Facilities	0.0 (1)	0.0 (1)
Construction Cost	$15,000	$15,000
Construction Labor (man-years)	0.3	0.3
Expected Year of Construction	1980	1980
Pennsylvania State Police Girard Sub-Station (impact only)		
Number of Facilities	0.2	0.1
Construction Cost	$35,000	$25,000
Construction Labor (man-years)	0.7	0.5
Expected Year of Construction	1979	1979

(1) Less than 0.5%.

Source: Law Enforcement baseline; Law Enforcement Working Paper; SIMPACT IV Model.

require an expenditure of approximately $30,000 for five patrol cars in addition to the $250,000 required to construct a new police station.

c) Operating Costs

4.200
The plant-related impacts on police department operating costs are expected to be quite similar to employment impacts since the approach used to estimate these costs was based on a per-employee expenditure requirement. The greatest portion is accounted for by salaries and benefits. However, as the overall department size increases, certain economies of scale take effect. Cost components such as building maintenance, lighting, supplies telephone switchboard, etc., remain constant, thus decreasing to some extent the total per-employee cost and the overall impact on expenditures.

Local Study Area

Conneaut

4.201
In the initial year (1979) of construction of the proposed plant, new resident population would have virtually no impact on the operating costs of the Conneaut Police Department. By 1981, it is expected that approximately $25,000 would be required in the department's budget to support two additional officers, some seven percent of projected baseline operating costs. In 1986, operating costs would increase by 26 percent, or $100,000, with the addition of seven employees. By 1990, projected baseline costs would be increased by $135,000, more than 30 percent, due to plant-related additions to the police force (refer to Table 4-95).

Springfield

4.202
The operating costs of the new Springfield police department associated with proposed plant development would be $10,000 in 1981, $55,000 in 1986, and $70,000 by 1990. These additional costs would represent approximately 20 percent of projected baseline costs in 1981, 90 percent in 1986, and 115 percent in 1990. It is noted that in both Conneaut and Springfield the percent increase in operating costs generated by new population would be somewhat less than the increase in police employment. This reflects the economies of scale associated with a larger force, in which fixed operating costs are spread across a larger employment base.

Table 4-95

Police Operating Expenditures in the
Conneaut and Springfield Local Study Areas -- 1979-1990

	1979	1981	1986	1990
Conneaut				
Construction-Related	$1,000	$10,000	$5,000	$0
Operations-Related	0	15,000	95,000	135,000
Total Impact	$1,000	$25,000	$100,000	$135,000
Baseline	$330,000	$355,000	$380,000	$400,000
Total Impact as a Percent of Baseline	-	7%	26%	34%
Springfield				
Construction-Related	$0	$5,000	$0	$0
Operations-Related	0	5,000	55,000	70,000
Total Impact	$0	$10,000	$55,000	$70,000
Baseline	$45,000	$45,000	$60,000	$60,000
Total Impact as a Percent of Baseline	-	22%	92%	117%

Source: Law Enforcement baseline; Law Enforcement Working Paper; SIMPACT IV Model.

Ohio Principal Study Area

Existing Conditions Alternative

4.203
Under existing conditions, the greatest additional operating costs for police services in the Ohio Coastal Communities would be $30,000 in 1990 with half expended in North Kingsville Village and the other half in Ashtabula City. In the same year an additional $75,000 would be required to support additional deputies required for the Ashtabula County Sheriff's Department (refer to Table 4-96). In North Kingsville Village, plant-related operating costs increases would be $15,000 in 1981-90. Although this represents a fairly sizable percent increase over projected baseline operating costs, the actual dollar expenditure requirement would be small. There would be no police department or associated operating costs in Kingsville Township. Development of the proposed plant would have only a minor impact on the costs of operating the Ashtabula City Police Department where an additional $10,000 in 1981, $15,000 in 1986, and $15,000 in 1990 would amount to only about two percent over baseline operating costs. In fact, declining population in the city may make it unnecessary to add more personnel for plant-related new population, thereby eliminating any increase in operating costs. Since there would be no local police department in Ashtabula or Saybrook Township under this alternative, there would be no operating budget impact. The costs of providing law enforcement in these communities would be borne by the county. The plant-related impact on the operating budget of the Ashtabula County Sheriff's Department, although greater under this alternative than under the local law enforcement scenario, would be minor. Impact-related operating expenses would be $55,000 in 1981 and $75,000 in 1986 and 1990, approximately six percent over baseline operating costs.

Local Law Enforcement Alternative

4.204
With local law enforcement responsibility in the Coastal Communities, total plant-related operating expenses would amount to $90,000 in 1990. In addition, projected baseline operating costs for new police departments in Kingsville, Ashtabula, and Saybrook Townships would be some $500,000. In this case, the additional budget required for the Sheriff's Department would be approximately $20,000 by the end of the projection period. With local law enforcement in Kingsville, the increase in operating costs would be $20,000 in 1981 and $30,000 in 1986 and 1990, twice the expected impact under existing conditions. In addition, a new police department in Kingsville Township would have a baseline operating cost of approximately $70,000 in 1979 and $90,000 by 1990. A local police department in Ashtabula Township

Table 4-96

Law Enforcement Operating Costs in the Ohio Principal Study Area and Key Coastal Communities -- 1979-1990 (Thousands of 1975 Dollars)

	Existing Conditions Scenario				Local Law Enforcement Scenario			
	1979	1981	1986	1990	1979	1981	1986	1990
Kingsville								
Construction-Related	0	15	5	0	1	10	5	0
Operations-Related	0	0	10	15	0	10	25	30
Total Impact	0	15	15	15	1	20	30	30
Baseline	51	58	70	80	120	130	150	170
Total Impact as a Percent of Baseline	-	26%	21%	19%	1%	15%	20%	18%
Ashtabula Township								
Construction-Related	0	0	0	0	0	5	5	0
Operations-Related	0	0	0	0	0	5	30	40
Total Impact	0	0	0	0	0	10	35	40
Baseline	0	0	0	0	200	190	195	215
Total Impact as a Percent of Baseline	-	-	-	-	-	5%	18%	19%
Ashtabula City								
Construction-Related	0	10	5	0	0	10	5	0
Operations-Related	0	0	10	15	0	0	10	15
Total Impact	0	10	15	15	0	10	15	15
Baseline	595	600	600	600	595	600	600	600
Total Impact as a Percent of Baseline	-	2%	3%	3%	-	2%	3%	3%
Saybrook Township								
Construction-Related	0	0	0	0	0	5	5	0
Operations-Related	0	0	0	0	0	5	5	5
Total Impact	0	0	0	0	0	10	10	5
Baseline	0	0	0	0	185	175	195	215
Total Impact as a Percent of Baseline	-	-	-	-	-	6%	5%	2%
Ashtabula County Sheriff's Department								
Construction-Related	0	35	20	0	1	10	5	0
Operations-Related	0	20	55	75	0	5	15	20
Total Impact	0	55	75	75	1	15	20	20
Baseline	1,070	1,105	1,170	1,235	1,070	1,105	1,170	1,235
Total Impact as a Percent of Baseline	-	5%	6%	6%	-	1%	2%	2%

Source: Law Enforcement baseline; Law Enforcement Working Paper; SIMPACT IV Model.

would have a baseline operating cost of approximately $200,000. Plant-related additions to this budget would be some $10,000 in 1981, $35,000 in 1986, and $40,000 in 1990, approximately 20 percent above projected baseline costs in that year. With local law enforcement in Saybrook Township, operating costs related to the proposed plant would be fairly small in comparison to expected baseline operating costs. The plant-related impact would be approximately six percent in 1981 and would decrease to less than three percent in 1990. Operating cost impacts on the Ashtabula City Police Department would be the same as those discussed above under the Existing Conditions Alternative. Under the Local Law Enforcement Alternative, additions to the budget of the Ashtabula County Sheriff's Department would be only $15,000 in 1981 and $20,000 in 1986 and 1990. Moreover, as discussed above, there might not be a need to increase the number of deputies under this scenario, so that there would be no impact on operating costs.

Pennsylvania Principal Study Area

Existing Conditions Alternative

4.205
With the existing distribution of law enforcement services in the Pennsylvania Coastal Communities, additional operating expenditures for all local police departments would be $50,000 in 1981 and would decrease to $30,000 by 1990. The expenditure decrease is a result of construction activity being terminated by 1990. The greatest relative impact would occur in the Girard Area; while projected plant-related expenditures would be larger in Millcreek, the impact would be smaller as a share of overall departmental operating costs. The maximum additional expenditure required for the Pennsylvania State Police would be $40,000, a worst case impact of five percent in 1990 (refer to Table 4-97). In the Girard Area, only $15,000 in additional operating expenditures would be required by the two existing departments to support plant-related new officers in the 1981-1990 period. There would be no additional personnel needed in Fairview Borough, so there would be no increase in projected operating expenditures generated by the proposed plant. The greatest dollar amount of plant-related costs would be incurred in Millcreek: $30,000 in 1981, $20,000 in 1986, and $15,000 in 1990. However, since the Millcreek Police Department is the largest in the Pennsylvania Coastal Communities, this would represent a very small increase over baseline operating costs amounting to three percent in 1981, two percent in 1986, and one percent in 1990. The plant-related operating costs for the Pennsylvania State Police would not be large. Under the Existing Conditions Alternative (the worst case impact on the State Police) new officers would generate additional expenditures of $35,000 in 1981, $35,000 in 1986, and $40,000 in 1990, approximately five percent over baseline requirements.

Table 4-97

Law Enforcement Operating Costs in the Pennsylvania Principal Study Area and Key Coastal Communities -- 1979-1990 (Thousands of 1975 Dollars)

	Existing Conditions Scenario				Local Law Enforcement Scenario			
	1979	1981	1986	1990	1979	1981	1986	1990
Girard Area								
Construction-Related	0	15	0	0	0	5	5	0
Operations-Related	0	0	15	15	0	5	20	30
Total Impact	0	15	15	15	0	10	25	30
Baseline	130	135	148	159	225	230	255	260
Total Impact as a Percent of Baseline	-	11%	10%	9%	-	4%	10%	12%
Fairview								
Construction-Related	0	0	0	0	0	10	5	0
Operations-Related	0	0	0	0	0	5	10	15
Total Impact	0	0	0	0	0	15	15	15
Baseline	35	43	55	65	150	145	160	160
Total Impact as a Percent of Baseline	-	-	-	-	-	10%	9%	9%
Millcreek								
Construction-Related	1	25	15	0	1	25	15	0
Operations-Related	0	5	5	15	0	5	5	15
Total Impact	1	30	20	15	1	30	20	15
Baseline	1,035	1,065	1,120	1,170	1,035	1,065	1,120	1,170
Total Impact as a Percent of Baseline	-	3%	2%	1%	-	3%	2%	1%
Pennsylvania State Police								
Construction-Related	0	35	20	0	2	20	10	0
Operations-Related	0	0	15	40	0	5	10	20
Total Impact	0	35	35	40	2	25	20	20
Baseline	550	615	705	800	550	615	705	800
Total Impact as a Percent of Baseline	-	6%	5%	5%	-	4%	3%	3%

Source: Law Enforcement baseline; Law Enforcement Working Paper; SIMPACT IV Model.

Local Law Enforcement Alternatives

4.206
With local law enforcement, the total impact on all local department operating costs would be $55,000 in 1981, $60,000 in 1986, and $60,000 in 1990. However, baseline operating costs for new departments would add approximately $200,000 to the required local Government expenditures. In this case, the additional budget required for the State Police would amount to approximately $25,000 (a four percent increase) in 1981 and would decrease in later years. To provide local responsibility for law enforcement in all of the jurisdictions in the Girard Area would require a total baseline operating budget of $225,000 in 1979 and $260,000 by 1990. Plant-related costs would be $15,000 in 1981, but would increase to $30,000 by 1990, twice the impact expenditures under the Existing Conditions Alternative. With local law enforcement in Fairview (a new department in Fairview Township), baseline costs would be $160,000 in 1990 compared to only $65,000 under existing conditions. Incremental plant-related costs would be $15,000 in the 1981-1990 period, an increase of approximately 10 percent over baseline operating costs. Operating cost impacts in Millcreek Township would be the same as those described under the Existing Conditions Alternative. Under this alternative, the required expenditure for State Police services due to the proposed plant would be only $25,000 in 1981, $20,000 in 1986, and $20,000 in 1990, an increase of less than five percent above baseline in all years.

d) Other Law Enforcement Issues

The Proposed Plant

4.207
The proposed plant is expected to employ security guards and watchmen for regular patrol activities at the site. Therefore, the plant itself would normally impose no demand on local police services. However, since security guards do not have police powers, any person apprehended on plant property in the commission of a crime would be turned over to the appropriate local jurisdiction for actual arrest and detention.

Traffic

4.208
The impacts on law enforcement services discussed above have been based on the number of new residents expected to live in the Principal Study Area due to the construction and operation of the proposed plant. However, there are also likely to be additional

requirements for police services created by increased traffic, particularly in the Conneaut and Springfield area. The greatest traffic impacts are expected to occur in 1981. Peak hour (7-8 a.m.) traffic in the area of the proposed plant could be as much as twice the level expected under baseline conditions. There will also be additional plant-related traffic on other roads throughout the Principal Study Area. Traffic-related police services in the Principal Study Area are provided by the Ohio State Highway Patrol, the Conneaut Police Department (for the portion of Interstate 90 which passes through the city), and the Pennsylvania State Police. It is difficult to quantify the additional police manpower required by plant-related traffic. To a large extent, additional highway patrol services for traffic law enforcement and provision of emergency assistance (i.e., dealing with accidents and breakdowns) would depend on established patrol patterns and future driving conditions on the affected roads. A reasonable estimate of additional traffic services needed would be four patrol officers for the major highways in the plant area (I-90 and US 20) during morning and evening rush hours, probably provided by the Ohio State Highway Patrol and the Pennsylvania State Police. There might also be a need for local police officers from Conneaut and Springfield to direct traffic at the plant gate exits. However, it is possible that additional service requirements could be met by temporarily reassigning officers from other parts of the three-county area or establishing temporary or part-time positions to meet peak construction quarter and peak hour needs.

Fire Protection

a) Personnel Requirements

4.209
Fire protection in the Coastal Communities is largely provided by volunteers or paid part-time personnel. Two notable exceptions are the city of Ashtabula which has a paid staff and Ashtabula Township which pays volunteers a small hourly wage on a per-call basis. The baseline and impact-related personnel requirements have been limited to the full-time paid firefighter classification since it is not possible to accurately estimate the number of volunteer firefighters needed in a given community. The minimum requirement for volunteers will vary depending on the number of paid personnel (if any), the types of fire alarms, and the availability of personnel over a 24-hour period. However, it is reasonable to assume that as populations increase in each of the Coastal Communities the number of volunteer firefighters will also increase.

Local Study Area

Conneaut

4.210
As shown in Table 4-98, the Conneaut Fire Department would require two additional firefighters in 1981, seven in 1986, and nine in 1990. The total number of paid firefighters exceeds the 1990 baseline projection by nearly 50 percent, which is greater than the anticipated rise in population (33 percent). This increase reflects the assumption that once the Lakefront Plant is built, more of the city's fire protection services would be performed by paid personnel. Overall, the 1990 ratio of paid firefighters to population would be 1.3 per thousand, which is fairly close to the national average of 1.5 per thousand for cities in the 10,000 - 25,000 population range.

Springfield

4.211
The Springfield Volunteer Fire Department currently provides all fire protection services in the Pennsylvania portion of the Local Study Area (Springfield Township and East Springfield Borough). Even with the proposed development of the Lakefront Steel plant, the population of the area would not reach the size necessary to require either a combination or paid department. Total population in Springfield in 1990 would be less than 7,000 and the threshold size assumed for a combination department is 15,000. However, additional volunteers would be needed to maintain current levels of service and it is likely that some of these volunteers would come from the new resident population.

Ohio Principal Study Area

4.212
Kingsville Township and North Kingsville Village currently have all-volunteer fire departments. Plant-related population growth would not be large enough to cause any change in department status; thus, there would be no plant-related requirement for adding full-time firefighters. However, additional volunteers would be needed, and some are likely to come from the new resident population. Ashtabula Township has a combination fire department which employs three full-time and 35 part-time firefighters. The part-time employees essentially function as volunteers but are paid a small hourly wage on a per-call basis. Projected plant-related population growth in Ashtabula Township would require hiring one additional full-time firefighter in 1986 and 1990, some 15 percent above expected baseline levels (refer to Table 4-98). There may also be a need for an increase in the part-time force, although the number of new part-time

Table 4-98

Estimated Requirements for Full-Time Firefighters in the Ohio Coastal Communities

	1979	1981	1986	1990
Local Study Area[1]				
Conneaut				
Construction-Related	0	1	1	0
Operations-Related	0	1	6	9
Total Impact	0	2	7	9
Baseline	13	14	17	19
Total Impact as a Percent of Baseline	--	14%	41%	47%
Principal Study Area				
Ashtabula Township				
Total Impact	0	0	1	1
Baseline	4	5	6	7
Total Impact as a Percent of Baseline	--	--	17%	14%
Ashtabula City				
Total Impact	0	1	1	1
Baseline	40	40	40	40
Total Impact as a Percent of Baseline	--	3%	3%	3%
Saybrook Township				
Total Impact	0	0	0	0
Baseline	3	3	4	5
Total Impact as a Percent of Baseline	--	--	--	--

(1) Springfield, part of the Local Study Area, is not included in this table because it presently has no full-time firefighters and is projected to need none under either baseline or impact conditions.

Source: Fire Protection baseline: Fire Protection Working Paper; SIMPACT IV Model.

firefighters required cannot be projected. The Ashtabula City Fire Department is the only fully-paid department with the Coastal Communities. It currently employs 40 full-time firefighters. With population in the city expected to decline, no additional employees would be required under baseline conditions. However, new population related to the proposed plant would create a requirement for one additional firefighter in the 1981-1990 period, an increase of 2.5 percent over the baseline level. However, since the city's overall population is expected to decline even with the influx of new residents, it is possible that this additional position would not have to be filled. Saybrook Township has a combination fire department currently employing three full-time and eight part-time firefighters; the department also has 40 volunteer members. Two additional full-time employees are expected under baseline conditions. Population growth in Saybrook generated by the proposed plant is expected to be quite small. As a result, there would be no requirement for additional full-time fire department employees above baseline levels, although the volunteer staff would likely be supplemented by new residents.

Pennsylvania Principal Study Area

4.213
All fire protection services in the Pennsylvania Coastal Communities are provided by volunteer departments. Even with plant-related population growth, it is not likely that these communities would require full-time paid firefighters. Neither the Girard Area nor Fairview Borough and Township would reach the 15,000 population threshold assumed to require a combination department by 1990, even with additional plant-related population. There also appears to be a decided preference in Erie and Crawford counties for volunteer departments. For example, five volunteer companies provide all fire protection services in Millcreek and are often called in under mutual aid agreements to assist the Erie City department, which has the only paid firefighters in the Principal Study Area. On the basis of these conclusions, it is anticipated that the proposed plant and related development would have no impact on fire protection employment in the Pennsylvania Coastal Communities. However, it is likely that local volunteer departments will supplement needs by recruiting new members as the population increases.

b) Facilities and Equipment

4.214
Facility requirements for fire protection are discussed in terms of fractions of a "typical" fire station. Equipment costs have been incorporated into facility construction costs because of the magnitude of the required expenditure (refer to the Fire Protection

Working Paper contained in Appendix B for "typical" facility size for each community). The requirements for additional fire protection facilities could be met in several ways. If construction of less than one fire station were needed in a given community, this requirement could be met by expansion of an existing station or the purchase of an additional piece of equipment to be based at an existing station. Similarly, if more than one fire station were needed, the requirement could be met by construction of a larger station or construction of a "typical" station and the purchase of additional equipment beyond that generally associated with the "typical" station. However, the actual station construction and/or equipment purchase needs would have to be determined by each local jurisdiction.

Local Study Area

4.215

Conneaut - Local officials in Conneaut have expressed a need for an additional fire station with or without the proposed project. However, much of the city's existing firefighting equipment is quite old and needs to be replaced. Therefore, it is likely that under baseline conditions the priority for fire department capital expenditures would be equipment purchase rather than new station construction. As a result of the construction of the Lakefront plant, a new station would probably be built. The facility requirement associated with nine new plant-related firefighters would be the equivalent of 0.7 station with an associated cost of $410,000. This expenditure would cover the cost of station construction and the purchase of a pumper, staff car, and communications equipment. Since this construction is already under consideration, it is likely that the new station would be built fairly soon, probably in 1980. An aerial ladder would also be needed for this station at a cost of some $165,000. However, the purchase of this truck could be put off until equipment at other stations had been replaced, probably until 1987, when plant-related population in Conneaut is expected to reach more than 5,000 persons (refer to Table 4-99). Springfield - A new fire station would also be needed in Springfield. The existing station is old and not centrally located and should probably be replaced even if the proposed plant is not built. Local officials are already discussing plans for a new station. Since the new fire station would be needed under baseline conditions, its construction would not be an impact directly attributable to the proposed plant. However, plant-related increases in population would create a requirement for additional firefighting equipment beyond that expected to be needed under baseline conditions. The Springfield Volunteer Fire Department currently has four relatively new vehicles which would be based at the new station. However, it is likely that the new population would require the purchase of two additional pumpers at a cost of approximately $55,000 each (refer to Table 4-99). The first would be needed

Table 4-99

Estimated Fire Protection Facility and Equipment Requirements
in the Principal Study Area
(Costs in 1975 Dollars)

	Year	Cost
Local Study Area		
Conneaut		
Fire Station (with pumper, staff car, and communications equipment)	1980	$410,000
Aerial Ladder	1987	$165,000
Springfield		
Pumper	1982	$ 55,000
Pumper	1986	$ 55,000
Principal Study Area		
Ashtabula Township		
Pumper	1985	$ 55,000
Ashtabula City		
Pumper	1981	$ 55,000

Source: Fire Protection baseline, Fire Protection Working Paper·
SIMPACT IV Model.

by 1982, when approximately 10 plant-related residents are expected in Springfield in the first full year of plant operations. The second is likely to be needed in the latter part of the forecast period (1985 or 1986), coincident with the influx of the majority of plant-related population (Girard currently has three pumpers and a population roughly similar to that expected in Springfield in 1990).

Ohio Principal Study Area

4.216
There are currently two fire stations in North Kingsville Village and one in Kingsville Township. It is anticipated that these facilities would be adequate under baseline and plant-related conditions since the population increase will not warrant a change in organization status of the fire department or the purchase of additional fire-fighting equipment. Small sums for facility construction are indicated in the communities of Ashtabula Township, Ashtabula City, and Saybrook Township as a result of increased population. However, there are currently two fire stations in Ashtabula Township and Ashtabula City and four in Saybrook; it is not likely that there would be any project-related requirement for new buildings. There is a project-related construction cost requirement of $70,000 in Ashtabula Township. However, based on the projected increase in population, it is not likely that a new station would need to be built. Instead, it is reasonable to assume that approximately $55,000 of this money might be spent to purchase an additional pumper (probably in 1985) to supplement the department's firefighting capability. The Ashtabula City Fire Department has five major pieces of equipment, three of which are more than 10 years old. In view of this situation, it is possible that the $40,000 construction cost estimated to be required due to proposed plant development would go toward the purchase of a new pumper. Given the age of the existing equipment, it is likely that a new truck would be purchased in the early 1980's. Saybrook Township is expected to have a very small construction cost impact generated by the proposed plant. Since the department's seven vehicles would probably be sufficient given population projections, it is not likely that any construction or equipment expenditures would be required.

Pennsylvania Principal Study Area

4.217
Based on projected increases in population, it is unlikely that the fire departments in the Girard area, Fairview, or Millcreek Township would be required to purchase additional equipment due to proposed plant development. The nine volunteer departments have approximately 50 pieces of equipment among them. However, aging equipment will need to be replaced periodically to maintain the efficiency of fire

protection services. The proposed project would have no impact on equipment costs in the Pennsylvania Coastal Communities even if new equipment is required. Equipment purchases in these communities are only partially funded by the local Governments. Money is raised through community activities (raffles, carnivals, donations) provide for normal operating requirements. Surplus funds are accumulated from year to year until enough is available to purchase a new piece of equipment. Plant-related population growth would, if anything, supplement the fund-raising capability of the local volunteer fire departments, either directly through increased donations or indirectly through increased tax revenues.

c) Operating Costs

4.218
Impacts on fire department operating costs throughout the Principal Study Area are expected to be generally the same as overall relative population changes, since operating expenditures have been estimated on a per capita basis. Operating budgets for the paid and combination departments in Ashtabula County are considerably higher than costs for volunteer departments, since the major budget component for the departments with full-time employees is salaries and benefits. For the volunteer departments there is no salary expense and generally operating budgets are used to finance the purchase and maintenance of firefighting equipment.

Local Study Area

Conneaut

4.219
In Conneaut the impact-related increase in operating costs is expected to be $20,000 in 1981, $80,000 in 1986, and $110,000 in 1990. This incremental impact on operating costs relative to the baseline would be approximately the same as the expected population impact: seven percent in 1981, 28 percent in 1986, and 36 percent in 1990 (refer to Table 4-100). However, overall fire department operating expenditures are expected to grow much more rapidly than population. Overall population (baseline plus impact) is expected to increase by about 40 percent over the 1979-1990 period, while the projected fire department budget would increase by about 60 percent. This reflects the anticipated shift to a fully paid department by the end of the forecast period. Although it is likely that this shift would occur without the Lakefront plant, the number of firemen and related equipment and facilities needed would be less if the plant were not built.

Table 4-100

Estimated Fire Protection Operating Costs in the Local Area -- 1979-1990 (Thousands of 1975 Dollars)

	1979	1981	1986	1990
Conneaut				
Construction-Related	0	10	5	0
Operations-Related	0	10	80	115
Total Impact	0	20	85	115
Baseline	262	275	300	320
Total Impact as a Percent of Baseline	--	7%	28%	36%
Springfield				
Construction-Related	0	1	0	0
Operations-Related	0	3	20	25
Total Impact	0	4	20	25
Local Government Contribution				
Total Impact	0	1	5	6
Baseline	8	8	9	9
Total Impact as a Percent of Baseline	--	13%	56%	67%

Source: Fire Protection baseline; Fire Protection Working Paper; SIMPACT IV Model.

Springfield

4.220
The relative incremental impact on fire department operating costs in Springfield is also expected to parallel population impacts. The total increase in fire protection expenditures related to the proposed plant would be approximately $4,000 in 1981, $20,000 in 1986, and $25,000 in 1990. However, only a small portion of this amount would be contributed by local Government ($1,000 in 1981, $5,500 in 1986, and $6,400 in 1990, increases of 13 percent, 56 percent, and 67 percent, respectively, over baseline estimates). The local Governments are expected to bear a greater share of overall fire department operating costs over the course of the 1979-1990 period. For example, in 1976 the Governments of Springfield Township and East Springfield Borough contributed only about 12 percent of total fire protection expenditures. However, as the demand for more comprehensive fire protection increases, the revenues derived from the annual carnival are not expected to increase as rapidly as overall budget requirements, although they are likely to still represent the major source of department funding. The local Governments would contribute about 25 percent of Springfield Volunteer Fire Department operating costs by 1990 as shown in Table 4-100. Although this arrangement appears to be adequate for the normal year-to-year operation of the fire department, it is possible that during the forecast period all or part of new equipment costs might need to be financed by the township and borough Governments, particularly since a greater population would generate a need for fairly large equipment expenditures. The need for local Government financing would depend on several factors, including the needs for additional equipment, availability of surplus revenues from community fund raising activities, and tax monies available to the municipal Governments not earmarked for other needs.

Ohio Principal Study Area

4.221
The impact on fire department operating costs in Kingsville Township and North Kingsville Village would be approximately $10,000 per year during the 1981-1990 period, about 20 percent above projected baseline cost (refer to Table 4-101) (baseline budget projections were made only for the North Kingsville Village Fire Department; the same per capita expenditure was assumed for Kingsville Township in order to estimate the level of impact for the entire community). However, even with this impact on expenditures, the total fire department operating budget would be only $65,000 in 1990, considerably less than in communities of similar size which employ paid firefighters. In Ashtabula Township, the additional operating budget requirement associated with the proposed plant would be $10,000 in 1981, $20,000

Table 4-101

Estimated Fire Department Operating Costs in the Ohio Coastal Communities -- 1979-1990
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Kingsville				
Construction-Related	0	5	0	0
Operations-Related	0	5	10	10
Total Impact	0	10	10	10
Baseline (*)	40	43	49	53
Total Impact as a Percent of Baseline	--	23%	20%	19%
Ashtabula Township				
Construction-Related	0	5	0	0
Operations-Related	0	5	20	25
Total Impact	0	10	20	25
Baseline	223	234	254	270
Total Impact as a Percent of Baseline	--	4%	8%	9%
Ashtabula City				
Construction-Related	0	5	5	0
Operations-Related	0	5	5	10
Total Impact	0	10	10	10
Baseline	531	531	531	531
Total Impact as a Percent of Baseline	--	2%	2%	2%
Saybrook Township				
Construction-Related	0	5	0	0
Operations-Related	0	0	5	5
Total Impact	0	5	5	5
Baseline	85	88	103	115
Total Impact as a Percent of Baseline	--	6%	5%	4%

(*) Operating cost projections for Kingsville Township are not available. Baseline was calculated by applying North Kingsville Village expenditure per capita to the population of the entire Kingsville area.

Source: Fire Protection baseline; Fire Protection Working Paper; SIMPACT IV Model.

in 1986, and $25,000 in 1990, about four percent, eight percent, and nine percent above baseline expenditures, respectively. In this community, the plant-related impact on fire protection costs would be only about half the population impact. This is because Ashtabula Township currently spends considerably more per capita than other combination departments in the county, due primarily to its large fleet of firefighting and rescue equipment. However, it is likely that the principal requirement due to projected increases in population would be for additional firefighting personnel rather than equipment. On this basis, the per capita impact on operating costs was assumed to be closer to that of Saybrook Township which has approximately the same number of employees but less equipment. Furthermore, since the part-time employees of the Ashtabula Township department are paid on a per-call basis, the salary component of operating costs would fluctuate from year to year based on the actual number of fire and rescue calls. The plant-related impact on the operating costs of the Ashtabula City Fire Department would be minor. The new resident population would generate additional expenditures of $10,000 per year during the 1981-1990 period, only two percent above projected baseline costs. Moreover, the city's population is expected to decline even with the development of the proposed plant so it is possible that the operating expenditures would not need to be increased above the projected baseline levels. The incremental increase in expenditures of the Saybrook Township Fire Department would be about $5,000 per year over the 1981-1990 period or about five percent of baseline projections. This is far smaller than the expected increase in baseline expenditures, which reflects not only increasing population, but also a rise in the level of fire protection services provided by paid personnel.

Pennsylvania Principal Study Area

4.222
The underlying assumption in the projection of municipal costs for fire protection services in the Pennsylvania Coastal Communities is that over time the local Governments will assume a greater share of fire department operating costs. As population and requirements for more comprehensive fire protection increase, it is likely that the revenues raised from community sources will not keep pace with overall budget requirements. In other words, per capita municipal expenditures for fire department operations are expected to increase. This assumption has been incorporated into the estimates of the share of impact-related operating costs expected to be borne by local Governments. However, non-municipal revenues are still expected to comprise the bulk of fire department operating budgets. In the Coastal Communities the plant-related impact on operating costs is essentially the same as the projected population increase, since operating costs are estimated on a per capita basis. The overall

increase in local Government fire protection expenditures during the 1979-1990 period is expected to be much greater than any incremental impact associated with the proposed plant. Even so, total expenditures incurred by the municipal Governments will be quite small in comparison to expenditures in communities of similar size with combination or paid departments. The actual revenues raised from non-Government sources are expected to vary considerably from year to year. In practice, the municipal contribution of operating costs is negotiated annually after community contributions have been received and budgets have been projected. The estimates in Table 4-102 represent a best estimate of the overall level of costs, although actual expenditures in any given year may be higher or lower.

Recreation

a) Primary Impacts

4.223
In addition to construction and operations related impacts, it is important to note that the entire site will be fenced. This will prevent fishermen and hunter access to site lands within the fenced area and will also eliminate existing land access to the U.S. East Breakwater Extension which is used by local residents. In mitigation for these losses, the applicant proposes to permit fisherman access by boat to the eastern breakwater and to the mouth of Turkey Creek and the contiguous beach area. The applicant also proposes to offer a 94-acre forested tract as an addition to Racoon Creek County Park or as a new Pennsylvania Game Lands unit to enhance hunting, fishing, and nonconsumptive outdoor recreational opportunities. The primary construction and operation impacts on recreational resources are defined in the following sections. Although no data concerning use of the eastern breakwater is known to exist, the applicant has indicated that during the warmer months of 1977, one to three individuals could generally be observed fishing there on any given weekday.

Construction

4.224
Construction activities associated with the development of the proposed Lakefront Plant will have a significant impact on certain on-site resources. Specifically, the following activities are considered to have the greatest effect: the replacement of 7,500 feet of Turkey Creek with 5,600 feet of culvert; construction in the beach areas west and east of the mouth of Turkey Creek; dredging of eastern Conneaut Harbor and construction of a materials conveyor and pier; and construction of transportation infrastructure on the proposed plant site. The recreational impacts associated with these activities are outlined below.

Table 4-102

Estimated Fire Department Operating Costs in the Pennsylvania Coastal Communities -- 1979-1990 (Thousands of 1975 Dollars)

	1979	1981	1986	1990
Girard Area				
Construction-Related	0	2	1	0
Operations-Related	0	2	8	11
Total Impact	0	4	9	11
Local Government Contribution				
Total Impact	0	0.5	1.1	1.3
Baseline	9	10	11	12
Total Impact as a Percent of Baseline	--	5%	10%	11%
Fairview				
Construction-Related	0	4	2	0
Operations-Related	0	2	4	5
Total Impact	0	6	6	5
Local Government Contribution				
Total Impact	0	0.1	0.1	0.1
Baseline	1	1	2	3
Total Impact as a Percent of Baseline	--	10%	5%	3%
Millcreek				
Construction-Related	0	11	6	0
Operations-Related	0	1	3	6
Total Impact	0	12	9	6
Local Government Contribution				
Total Impact	0	0.5	0.3	0.2
Baseline	18	18	19	20
Total Impact as a Percent of Baseline	--	3%	2%	1%

Source: Fire Protection baseline; Fire Protection Working Paper; SIMPACT IV Model.

Alteration of Turkey Creek

4.225
Replacement of 7,500 feet of Turkey Creek streambed with 5,600 feet of culvert will result in the permanent loss of this reach of stream as habitat for game fish. However, in contrast to the applicant's original plan to divert the creek into Conneaut Creek via channelling, the current plan specifies that the lower 1,500 feet of creek and areas upstream from the site of the proposed culvert remain intact. The culvert would be designed with baffles and resting pools and a skylight system to facilitate upstream migration of salmonids. Additionally, the applicant intends to augment the flow of the creek during peak migration periods by diverting some plant intake water into the upstream end of the culvert in order to eliminate low flows which present a formidable barrier to salmonid migration and to maintain more suitable water temperatures. The downstream end of Turkey Creek will be subject to habitat improvements under the direction of the Ohio Department of Natural Resources to increase the potential for successful spawning by rainbow trout while the sections of creek upstream of the culvert will be available to the Pennsylvania Fish Commission for management. In conjunction with these programs, the applicant has also agreed to allow fishermen access by boat to the mouth of Turkey Creek and the adjoining beach. Fishermen will also be allowed access to the east breakwater by boat but access by land will be restricted.

4.226
Construction of the proposed plant will also entail the permanent removal of riparian wildlife habitat. The elimination of this habitat will result in the direct mortality of wildlife and the emigration of the remaining individuals. Adjacent habitats are probably at or close to carrying capacity. Increased populations caused by the emigration can result in starvation and disease. These impacts would occur on the Lakefront Plant wildlife and the resident population of the adjacent areas. As previously mentioned, the "primary impact area" will be enclosed by fence and public access will be denied to the remainder of the site.

4.227
Table 4-103, provided by the Pennsylvania Game Commission, shows the resources and hunter man/days lost as a result of plant construction on the Pennsylvania segment of the site. The 1,044-acre portion of this tract designated for plant construction provided an annual average of 293 man-days of hunting for the major game species. This is minimum figure as it does not include hunting for the minor game species and predators and trapping for furbearers. Projecting this figure for the entire 2,916 acres indicates this area provided a minimum of 818 man-days of public hunting. The loss of this

Table 4-103

Average Annual Impact of Habitat Loss on Major Wild Bird and Mammal Species on Pennsylvania Segment of Proposed Site for U.S. Steel Lakefront Plant

Species	Acres Habitat Lost	Fall Population Loss	Annual Population Loss	Kill Loss	Value Kill Loss	Hunter Man-Days Lost
Woodcock (Resident)	399	158	199	14	$ 37.94	6
Woodcock (Migrating)	399	1,200 1/ 2/	NA	54	146.34	23
Ruffed Grouse	799	197	295	40	367.60	135
White-tailed Deer	1,003	10	13	2	1,991.14	62
Cottontail Rabbit	383	273	1,199	46	1,134.82	54
Fox Squirrel	101	73	110	7	50.82	13
Raccoon	783	125	156	13	1,282.32	-
Fox (Red & Gray)	1,003	14	17	2	164.40	-
Totals	1,003	850 3/	1,990 3/	178	$5,175.38	293

1/ Read maximum fall population instead of fall population loss.
2/ Density figures from Bennett and English (1947).
3/ Resident only.

Source: Pennsylvania Game Commission

recreational resource is significant, especially in an area where demand for hunting opportunity will increase while such opportunity will actually decrease due to secondary development related to plant construction.

4.228
Hunters in Pennsylvania spend approximately $250 million annually in hunting-related costs, making sport hunting one of the major businesses of the Commonwealth (Hartman, 1973, 1975). The Game Commission has previously reported that hunters in Erie County spend approximately $8,750,000 a year in pursuit of their sport (Palmer, 1978b). It is possible to determine, on the basis of money expended per animal bagged, the value of the game harvest. Table 4-103 shows the value of the harvest on the construction area of the major game species to be $5,175.38 at current values. Projected total for the entire tract is $14,455.71. Again, this is a minimum value since it does not include minor game species and predators. Distribution of hunter expenditure is too complex to permit a direct assessment of the economic aspects of reduced hunting opportunity. However, the greatest impact occurs on the local economy.

4.229
There are no data available to quantitatively assess the recreational and economic effects due to the loss of furbearer trapping and non-comsumptive wildlife-oriented recreation. Current fur prices make trapping economically significant, and the value of nonconsumptive recreation may equal or exceed that of hunting in many cases (Skrow, 1977).

Construction in the Beach Areas East and West of the Mouth of Turkey Creek

4.230
Construction of the intake and discharge structures off the shoreline east of the mouth of Turkey Creek is expected to require blasting, which may cause Lake Erie fish species to avoid the area as long as this activity occurs. Establishment of oil, ore, pellet, and stone storage areas near the beach area west of Turkey Creek is not expected to harm the beach itself, but the presence of these facilities will probably restrict access to the lakeshore for those individuals that are able to enter the plant site, thereby eliminating lake fishing opportunities. Anticipated shoreline stabilization would eliminate the beach area and a portion of the littoral zone. However, this loss may be offset to some extent if sheet piling or concrete bulkheads are used, but the loss of beach and littoral habitat will be complete.

Construction Along Conneaut Creek and in Conneaut Harbor

4.231
Construction runoff could adversely impact water quality in Conneaut Creek and reduce the quality of this water course as a recreational sport fishing resource. Dredging and pier construction activities in Conneaut Harbor are expected to cause reduction of suitable gamefish spawning and feeding habitat and disturbance of resident fish species through sedimentation and siltation, thus effecting the sport fishing potential of this area as well. The presence of construction equipment in the vicinity of the pier extension and dredging area may pose a hazard to small craft navigation in the Conneaut Outer Harbor. Construction of the overhead conveyor between the dock and shoreline has sufficient clearance to accommodate most recreational small craft and should not restrict their movement.

Construction of Plant Transportation Infrastructure

4.232
Some runoff from plant construction, the construction and surfacing of the western access road and remaining dirt roads on the plant site is expected to flow toward Lake Erie and into Conneaut Creek and Turkey Creek. Contaminants such as lead, oils, and road salts may be contained in this runoff and when added to the silt load, may have an adverse effect on resident fish species and thus recreational sport fishing. If conditions in Conneaut Creek and along the lake shoreline become such that recreational sport fishing is inhibited, then sportsmen would be expected to travel to other portions of Conneaut Creek, to Conneaut Harbor, or to the beach area west of the Conneaut Harbor breakwater to engage in this activity. Under these conditions an increase in fishermen pressure could occur.

Operations Period

4.233
Activities which could potentially effect recreational pursuits during regular operations at the proposed Lakefront Plant include the following:

- Increase deep draft shipping traffic in Conneaut Harbor between Lake Erie and the P&C Dock Company unloading facilities,
- Maintenance dredging around the extended and new piers,
- Discharge from the effluent diffuser,
- Runoff into Conneaut Creek and Conneaut Harbor,
- Plant air emissions, and
- Accidental oil or debris spills into Conneaut Creek, Conneaut Harbor, or Lake Erie.

Increased Ship Traffic in Conneaut Harbor

4.234
Although there will be some rise in heavy shipping traffic during the construction period, the greatest increases are expected during the operations phase. The influx of barges and deep draft shipping will pose a hazard to small craft maneuvering especially when approaching or leaving dock areas.

Maintenance Dredging

4.235
Maintenance dredging in the vicinity of the extended and new piers in Conneaut Harbor would periodically affect the lake fishery. Scheduling of dredging operations must be determined carefully to insure that the dredging operation does not interfere with the migration or spawning of fish species. Even if the dredging is performed during noncritical periods, the siltation of adjacent habitat on a continual basis may reduce its overall quality for fish spawning or foraging activities. The physical presence of dredging equipment could impinge on harbor fishing activities and small craft movement, particularly if pipeline dredges are used.

Discharge from the Effluent Diffuser

4.236
The main wastewater discharge from the plant into Lake Erie is not expected to have a significant impact on recreational fishing areas. The distance of the diffuser from shore coupled with the predominant west to east lake currents will prevent degradation of game fishing areas along the shore.

Runoff Into Conneaut Creek and Conneaut Harbor

4.237
Runoff from the Lakefront site during normal operations will be directed into improved collection facilities where it will be treated prior to its release to Conneaut Creek or Conneaut Harbor.

Plant Air Emissions

4.238
The attractiveness of Raccoon Creek County Park as a recreation area for residents of nearby coastal communities may be impaired by the effects of plant air emissions on human health or aesthetics. The applicant expects that sulfur dioxide (SO_2) will be emitted in some concentration from the proposed Lakefront Plan. This gas could react with water vapor or rainfall to form sulfuric acid (H_2SO_4). The

presence of this material over the long term could adversely affect game populations. Although exposure to acid rain and plan emissions can conceivably occur in the coast communities, the frequency and duration of such exposure is dependent on meteorological conditions.

Accidental Oil or Debris Spills into Conneaut Creek, Conneaut Harbor, or Lake Erie

4.239
Oil or debris spills can occur as a result of plant-related truck and rail traffic accidents on creek overpasses and bridges. Mishaps involving lake vessels into and out of Conneaut Harbor may also result in the spillage of oil or the release of debris. Debris spills could cause navigational hazards for small watercraft and could pollute as well as damage boat mooring areas in Conneaut Harbor. Oil spills are dangerous not only to fish species but also to migrating waterfowl and other fauna.

b) Secondary Impacts

Ohio

Ohio Local Study Area

4.240
Construction-Related. Secondary impacts on recreation in the Ohio Local Study Area would amount to slightly increased demands on existing recreational facilities during the construction period. The number of new Conneaut residents who will potentially use the recreational facilities during the Step I construction period is estimated to increase to a peak of about 600 persons in 1981. During Step II, the new Conneaut resident population is projected to increase from 20 in 1984 to about 250 in 1986. Most recreational demands would occur during the week as an estimated maximum of 200 construction employees (1981), who work in the area only during the week and return home on weekends, take advantage of Conneaut City and Township park facilities. The workers actually moving to Conneaut with their families may also take advantage of these and other facilities on a regular basis, extending their usage into the weekend periods. In addition to increased demands on land-based facilities, there may be a slight increase in the use of boat launching and mooring facilities. The demand for such facilities is expected to occur largely on weekends. It does not appear reasonable to expect weekly construction workers to use boat launching and mooring facilities. The overall increase in the use of the boating facilities may impose a hardship by lengthening the waiting time at the four public launching ramps.

4.241
Operations-Related. Starting in 1981, demands on recreational facilities by the approximately 550 new residents projected would begin to increase as the plant operations started up. By 1990, the number of operations-related residents is projected to rise to an estimated 5,300 persons, increasing overall usage of public ballfields, beaches, and picnic tables in Conneaut Township Park and Lakeview Park and possibly Farnham Park. There may also be increased use of privately-owned facilities open to the public, such as Evergreen Lake Park and the Conneaut Shores golf course. Private clubs with substantial recreational acreage such as the Amboy Rod and Gun Club (80 acres) and the Conneaut Fish and Game Club (91 acres) may receive requests for membership from persons who would normally have hunted and fished around Turkey Creek on the proposed plant site. The most significant recreational demand would be placed on the boat launching and mooring facilities in Conneaut. With 5,300 new residents, it is unlikely that the presently crowded public facilities could support the expected increase in demand for launching and mooring sites. Requests for membership in the private Conneaut Boat Club, Lake Erie Boating Club, and Snug Harbor Marina, all of which already have limited capacities, will probably increase.

Other Ohio Coastal Communities

4.242
Kingsville Township and North Kingsville Village. During the construction period, it is projected that some weekly construction workers would reside in Kingsville Township and North Kingsville Village with peaks of 105 and 70 in Steps I and II of construction (1981 and 1986, respectively). The overall number is not expected to make significant demands on recreational facilities in the township, though there may be some interest in swimming in Kings Lake and fishing in Conneaut Creek. The construction personnel may also use Village Green Park in North Kingsville Village for swimming, fishing, and baseball. Camping areas will probably not be used by the weekly workers, although during the warmer months of the year they may become attractive. Significant recreational impacts will occur in Kingsville Township and North Kingsville Village facilities as a result of the projected increase construction-related new resident population. At present there is an average of 500 seasonal users of the campground facilities, and with the new resident increment in the village, this number would certainly grow. The new residents would also utilize the ballfields, swimming and fishing areas, and picnic areas, increasing the overall demand for these facilities. At the start of plant operations in 1981, about 360 new residents are expected to come to Kingsville Township and North Kingsville Village; this number is expected to continue to grow, reaching about 960 in 1986, and 1,200 in 1990. These residents will become more

established in the community and may therefore create different demands on recreational facilities. In addition to using the fishing, swimming, picnicking, camping, and ballfield areas, these new residents may be regular users of the Village Green golf course and tennis courts. Some of these residents may also wish to send their children to the private church camps, Camp Calvary and Camp Luther, increasing the usage of these recreational facilities. The most significant demand may be for boating access to Lake Erie. At present there are no mooring or launching facilities in Kingsville Township, and because the facilities in neighboring Conneaut are expected to become more crowded there may be increased demand for such boat launching and mooring outlets in Kingsville.

4.243
Ashtabula City and Township. During the construction period, secondary impacts on recreational facilities would probably be greatest in Ashtabula City. There is only one other recreational facility, Hide-A-Way Campground, in the township. It is unlikely that weekly construction workers would use this camping area, but some of the new township residents may take advantage of the facilities on weekends. In Ashtabula City and Township, the number of new construction-related residents is expected to peak in 1981 at approximately 590 persons. These residents would probably use the Ashtabula City facilities including the ballfields, beach, pool, and picnic area at Walnut Beach Park, the picnic tables at Lake Shore Park, and the hiking and picnicking areas at Indian Trails Park. There may also be some slight increase in use of the tennis courts in Walnut Beach Park and Lake Shore Park, but this use increment is not expected to be significant. Although it is unlikely that many construction-related residents will use the boat-launching and mooring areas, there may be a slightly increased demand during the peak construction years 1981 and 1986. At the start of plant operations in 1981, it is projected that there would be appproximately 320 new operations-related residents in Ashtabula City and Township. This number is projected to increase to an estimated 2,200 persons by 1990, thus placing significant demands on recreational outlets. However, Ashtabula City has been losing residents in recent years, and is projected to continue to do so under baseline conditions. Ballfields and other park facilities in Ashtabula City would be more heavily used but perhaps the most significant demands would be on the boat launching and mooring sites. There is already an excess of demand for mooring areas within the city at both the public and private sites, and with new residents coming in, this demand could become more acute. It is likely that the private Ashtabula Yacht Club and Riverside Yacht Club, both filled to capacity at present, will experience increased demands for membership.

4.244
Saybrook Township. In 1981, a maximum of about 260 new construction-related residents are expected to live in Saybrook Township. Recreational impacts are expected to be minimal due to this small population increment. New residents may use Saybrook Township Park, but the facilities are expected to easily bear the small incremental demand. The expected maximum of about 100 weekly Saybrook construction-related residents may also use the park facilities, but this use would also be expected to be easily borne. In addition to use of the Saybrook Township Park facilities, use of the three privately-owned golf courses in Saybrook Township may increase during the operations period. The expected maximum of 170 new operations-related residents in this community may be interested in joining the private Ashtabula Rod and Gun Club, which provides fishing and shooting acreage. The only launching and mooring facilities for small craft are owned by the Redbrook Boat Club; thus there may be increased pressure to join this private organization.

The Rest of the Ohio Regional Study Area

4.245
Secondary recreational impacts during the construction and operations period would involve increased use of camping facilities in Andover and Jefferson Townships and increased use of the Ohio Pymatuning State Park facilities. These recreational sites would be able to successfully handle the increased demands since they have substantial acreage and facilities which are capable of accommodating a large number of users. Boating at Pymatuning State Park may become even more popular than at present, especially if small craft launching facilities along Lake Erie become more competitive during plant operations. Two private golf courses may experience some increased demand for membership during the operations period: the Conneaut Country Club in Monroe Township and Pymatuning Valley Golf Course in Andover. Should plant-associated residents move to Geneva Township, there may be slightly increased use of Geneva-on-the-Lake State Park. Residents interested in fishing may travel to the Grand River near Harpersfield and Austinburg, and for hunting, users may travel to the New Lyme and Orwell Wildlife Areas.

Pennsylvania

Pennsylvania Local Study Area

4.246
Construction Related. The impacts on Springfield recreational facilities will be relatively minor secondary impacts during the Lakefront Plant construction phase. Overall, the number of construction workers, projected to peak in 1981 at about 135 persons, may

cause increased demand upon Raccoon Creek Park. None of the construction workers are expected to live in Springfield, instead many will choose Millcreek or Erie City. Under these circumstances, it is reasonable to assume that workers living in Millcreek and Erie would most likely use Presque Isle State Park and nearby hunting areas.

4.247
Operations-Related. Under the projected growth scenario, Springfield Township and East Springfield Borough would experience greatest recreational impact in the latter phase of the operations period, 1986 through 1990. By that time, nearly 3,000 new plant-related residents are projected to be living in Springfield on a permanent basis. The new population would differ from the construction worker group in that its recreational preferences are expected to be similar to those of the present baseline population. Since boat launching facilities and beach swimming areas are already inadequate to meet current demand, additional facilities demands would be aggravated during the operations period beginning in 1981.

Other Erie County Coastal Communities

4.248
Girard Area (Girard Township and Borough and Lake City and Platea Boroughs) The addition of construction-related population in Girard will be small but some proportion will probably travel to Elk Creek for fishing and pleasure boating. Elk Creek appears to have adequate public access to its shores at this time, however, access to Lake Erie via marinas or boat ramps is limited. The expected influx of users due to projected baseline population growth of about 295 persons and the projected construction-related population of about 260 persons could seriously aggravate the situation by 1981. Demand on Girard recreational facilities during the operations period will increase usage of picnic and camping areas. There may be some increase in the number of individuals seeking membership in the Overlake Golf Club.

4.249
Fairview Township and Borough. Walnut Creek and Trout Run are the two major fishing areas within the township expected to receive the majority of construction workers usage during the period 1979 through 1981. The usage of these two recreational areas is considered to be high since 50 percent of the immigrating construction workers are projected to live in the adjacent communities of Millcreek and the city of Erie. Erie City has no important creeks or streams, and workers seeking fishing and pleasure boating areas will probably travel to Walnut Creek (in Fairview or Millcreek) and Trout Run. It is estimated that during the operations phase approximately

530 operations-related personnel would reside in the Fairview Area by 1990. The combination of Fairview's baseline population growth and the proposed plant-related population is likely to exert demand for additional parks and camping/picnic areas.

4.250
Millcreek Township. By 1981, when the construction phase of the Lakefront Plant is expected to be at its peak, Millcreek is projected to house approximately 28 percent of the new Pennsylvanian plant-related population. That portion of the new resident population which is interested in water-related recreational activities would have to go to Walnut Creek or nearby areas (Fairview, Girard, or Presque Isle State Park) for boating and fishing. By the end of the peak operations period (1981 through 1986), Millcreek is projected to have approximately 270 additional residents and by 1990, 530 new residents. The new residents are expected to have recreational preferences similar to those of the existing population, and would probably utilize such areas as Presque Isle State Park, local creeks, and Pymatuning State Park. Both Presque Isle and Pymatuning State Parks are large enough to comfortably serve the needs of this population; however, local creeks and boat launching areas may become increasingly overcrowded.

The Rest of the Pennsylvania Regional Study Area

4.251
Projected plant-induced population increase in the Pennsylvania Principal Study Area is estimated to be approximately 3,000 by 1986, growing to 7,300 by 1990. This population is considered likely to have recreational preferences similar to those of the existing population and would probably make use of such areas as Pymatuning State Park, Conneaut Lake, Woodcock Creek Lake, Col. Crawford Park, French Creek, and the 12 State game land areas in Crawford County. There may be increased hunting on State Game Land Unit 101 by plant-related workers. This area is only 10 miles south of the proposed project site.

Social Services

a) Social Services Considerations Related to the Proposed Lakefront Plant

Baseline Considerations

4.252
The approach used to estimate future social services costs is based on each county's 1975 per capita expenditure for major Federal and State-mandated programs. Inherent in this approach is the assumption

that there will be no significant changes in the structure of the social services delivery system over the projection period. However, changes in eligibility requirements, real expenditures per recipient, employment or job training programs for public assistance clients, or possible Federal "welfare reform" programs could all have significant impacts on county expenditures for social services programs. Similarly, national and regional economic conditions would affect the number of people requiring public assistance support.

Impact Considerations

4.253
The population growth related to the proposed plant could significantly impact social services and related costs. If there is a large in-migration of individuals seeking employment at the facility and a substantial number are unsuccessful or compelled to wait for suitable employment, then social service assistance may increase beyond normal baseline projections. It is difficult to predict to what extent the proposed plant would attract unemployed in-migrants to the area. For example, there are indications that in the western part of the United States, especially the "Sun Belt," the construction and operation of large industrial and public works projects often result in an influx of workers without any promised position who, when no job turns up, must fall back on some form of public assistance for at least a short period of time.

4.254
In general, it is not possible to transfer the experiences in the western United States to the Regional Study Area. Many of the "Sun Belt" developments are relatively isolated from major population centers with high unemployment, and persons hoping to find employment there must relocate. However, in the North Central United States, new plant sites are more accessible. It is likely that unemployed workers from areas such as Youngstown, OH, and even as far away as West Virginia would initially commute to the proposed site in order to find jobs. This assumption is borne out by events at two major facilities which have opened up in recent years, namely the General Motors assembly plant at Lordstown, Ohio, and the Bethlehem Steel facility at Burns Harbor, Indiana. (4-2) Information on these developments provides no clear evidence that social services costs increased disproportionately during either the construction or operations phase. Further, it can be anticipated that the majority of workers attracted to the Regional Study Area without firm positions at the facility or in ancillary functions would migrate from industrial centers in other areas of Ohio and Pennsylvania. If these individuals were already receiving assistance through various State programs, there would be little addition to costs at the State level, which is where the majority of non-Federal costs are incurred.

4.255
Another possible effect of the proposed plant would be an increase in the local cost of living beyond what might be expected under baseline conditions, that is, a large number of relatively high-paying jobs at the plant and related industries could raise costs in the area for housing, medical care, food, etc. This would require a larger payment to families receiving AFDC, Medicaid, or General Relief in order to provide basic necessities. Although this would not increase the number of social services recipients, it would increase per capita costs beyond the levels expected under baseline conditions. Furthermore, a significant increase in the cost of living might also increase the number of public assistance recipients, particularly among the elderly population. If basic necessities become more expensive, some people with fixed incomes (such as pensions) may no longer be able to afford these items without some financial support through social services programs.

4.256
On the other hand, construction of the proposed plant could reduce the number of persons requiring financial assistance under various social services programs and thus reducing the overall and per capita expenditures. None of the construction or operations related new households in the Regional Study Area would be expected to require financial assistance under the major social services programs. However, some would likely make use of some human service programs provided by public and private agencies such as family planning services, various health screening programs, etc. Since all workers employed at the plant would receive relatively high salaries, those individuals would not create increases in expenditures for such programs as AFDC, Medicaid, Food Stamps, and Child Welfare. An exception to the assumption that new resident workers would not require financial assistance is that there may be a short-term social services expenditure requirement for some construction workers. The construction of the plant is expected to take place in two steps with a period of about one and one-half years between them. Those workers who move to the Regional Study Area will be those who expect to be able to find jobs on other projects in the area even when there is no construction activity at the site. Those workers who expect only short-term employment at the proposed plant would likely become weeklies and would have no impact on social services requirements since they would not be true "permanent" residents of the Regional Study Area.

4.257
It is possible that there may be some short-term unemployment among the construction "movers" and also original residents employed in the construction trades. Depending on the availability of other construction work in or near the Regional Study Area, it may take

some of these workers several months to find another job when Step I of construction activity at the proposed plant ends in 1982. If this occurs, some families may require assistance under such programs as Medicaid or Food Stamps to supplement unemployment insurance benefits. This would create a short-term increase in total and per capita social services expenditures. Development of the proposed plant could also reduce social services requirements below what might be expected under baseline conditions. A large part of both the construction and operations workforce is expected to be composed of Regional Study Area residents. In addition, secondary jobs created by plant operations and plant related new population are expected to be filled mostly by these residents. New employment opportunities and a decrease in the unemployment rate could reduce the number of families requiring public assistance support under Federal and State social services programs. This would serve to reduce the number of recipients and county per capita expenditures.

b) Social Services Costs

4.258
Although the unpredictable and fluid nature of the many social services considerations discussed above makes any projections of future county expenditures under either baseline or impact conditions extremely difficult and tenuous, estimates of impact-related costs are presented in this subsection. This has been done to attempt to project the incremental impact of proposed plant development as an input to the overall regional fiscal analysis. However, it should be understood that these are not high precision estimates and that actual expenditures during the projection period could be significantly higher or lower. In both Ohio and Pennsylvania, the local share of costs for both Federal and State social services programs is borne at the county rather than the municipal level. Therefore, impacts associated with the proposed plant are described in terms of the Regional Study Area in each State. Although all of the new resident population is expected to live in the Principal Study Area, it is not possible to disaggregate social services costs below the county level. It is also necessary to recognize that a significant portion of the construction-related new population in both 1981 and 1986 is composed of weekly workers. These workers would not have any appreciable impact on social services requirements or costs since they would not be true "permanent" residents of the Regional Study Area. That is, they would only live in the Regional Study Area while they were working at the plant and would return to permanent residences on weekends and when construction activity is completed. However, these workers have been included in the total new resident population figures used to calculate social services cost impacts to provide a conservative ("worst case") estimate.

Ohio Regional Study Area

4.259
The majority of social services expenditures in Ashtabula County are associated with three programs, AFDC, Medicaid, and General Relief. The county's expenditures for these programs are quite small in comparison to total costs, amounting to approximately $210,000 by 1990. The incremental increase in expenditures due to the proposed plant would be fairly small, $7,000 in 1981, $16,000 in 1986, and $19,000 in 1990, about nine percent of expected baseline costs in that year (refer to Table 4-104). If weekly construction workers are excluded from the plant-related population, incremental social services expenditures would decrease to $6,000 in 1981 and $15,000 in 1986.

Pennsylvania Regional Study Area

4.260
County-funded social services programs in the Pennsylvania Regional Study Area include Mental Health/Mental Retardation, Council on Aging, and Child Welfare. Although plant-related social services expenditures in Erie and Crawford Counties would be higher than those expected in the Ohio Regional Study Area, the percentage impact would be significantly smaller due to much larger baseline expenditures in this area. Expenditures associated with the new resident population would be $1,000 in 1979, $16,000 in 1981, $24,000 in 1986, and $25,000 in 1990, less than two percent of baseline costs in all years (refer to Table 4-105). If weekly construction workers are excluded from the new resident population, incremental social services expenditures in the Pennsylvania Regional Study Area would be $9,000 in 1981 and $21,000 in 1986. It is anticipated that the majority of these expenditures would be required in Erie County. In fiscal year 1975-1976, Erie County's costs amounted to more than 80 percent of local social services expenditures in the two counties. Furthermore, it is expected that most of the new resident population would live in the Coastal Communities in Erie County and the Erie City portion of the rest of the Principal Study Area. The population increase in Crawford County would be considerably smaller.

General Government

4.261
The projected increase in population as a result of the proposed Lakefront Plant is not expected to alter the scope of general Government services in the Principal Study Area. However, in some areas local Governments may have to add employees and increase expenditures to maintain the present level of service. Such increases are expected to be highest for the municipalities in the Local Study Area where most new residents are expected to locate. A histogram

Table 4-104

County Social Services Costs
in the Ohio Regional Study Area -- 1979-1990 (1975 Dollars)

	1979	1981	1986	1990
Construction-Related	$0	$4,000	$2,000	$0
Operations-Related	0	3,000	14,000	19,000
Total Impact	0	$7,000	$16,000	$19,000
Baseline	$197,000	$199,000	$205,000	$209,000
Total Impact as a Percent of Baseline	-	4%	8%	9%

Source: Social Services baseline; Population baseline; SIMPACT IV Model.

Table 4-105

County Social Services Costs
in the Pennsylvania Regional Study Area -- 1979-1990 (1975 Dollars)

	1979	1981	1986	1990
Construction-Related	$1,000	$12,000	$6,000	$0
Operations-Related	0	4,000	18,000	25,000
Total Impact	$1,000	$16,000	$24,000	$25,000
Baseline	1,540,000	$1,560,000	$1,615,000	$1,655,000
Total Impact as a Percent of Baseline	-	1%	1%	2%

Source: Social Services baseline; Population baseline; SIMPACT IV Model.

illustrating the overall impact of the added population on Government expenditures is presented in Figure 4-25.

a) General Government Employment

Ohio Local Study Area

4.262
The impact on general Government employment requirements in Conneaut is estimated to be greatest in 1990, when about six additional full-time equivalent employees would be needed (refer to Table 4-106). This requirement would represent an increase of about 50 percent over projected baseline employment requirements. In 1981 the projected employment requirement is about one full-time equivalent employee, which is equal to about 10 percent of projected baseline employment. Employment requirements would not become substantial until there is a significant population increase resulting from the operation of the plant. This is projected to begin in 1982 when there would be a requirement of about three additional full-time equivalent employees or 26 percent of baseline general Government employment. Available data are not specific enough to denote which functions within the general Government category would require additional personnel. However, there are several possibilities, including the need for additional personnel to work in financial functions as the increased population produces heavier administrative workloads in income tax collection or the assessment of fees and charges, additional manpower in the planning, zoning, and inspection functions, and increase in court personnel. During the peak construction period in 1981, an additional 1.2 employees would be required. It is likely that this need could be met through the use of part-time clerical assistance.

Pennsylvania Local Study Area

4.263
General Government employment requirements in Springfield Township are also projected to peak in 1990, when about one additional full-time equivalent employee would be needed as shown in Table 4-106. Although this requirement is relatively small compared to that of Conneaut, its impact is more significant in relation to expected baseline requirements, exceeding the baseline projection of 0.7 full-time equivalent employees. In this case the additional employment would be needed to handle the administrative and financial functions associated with the larger population. This requirement could be met either by adding a full-time clerical employee or one or more part-time employees. Since the Springfield area is expected to remain small (less than 7,000 people) it is not expected to require an administrative structure and associated employment levels characteristic of more urbanized areas such as Conneaut or Ashtabula City.

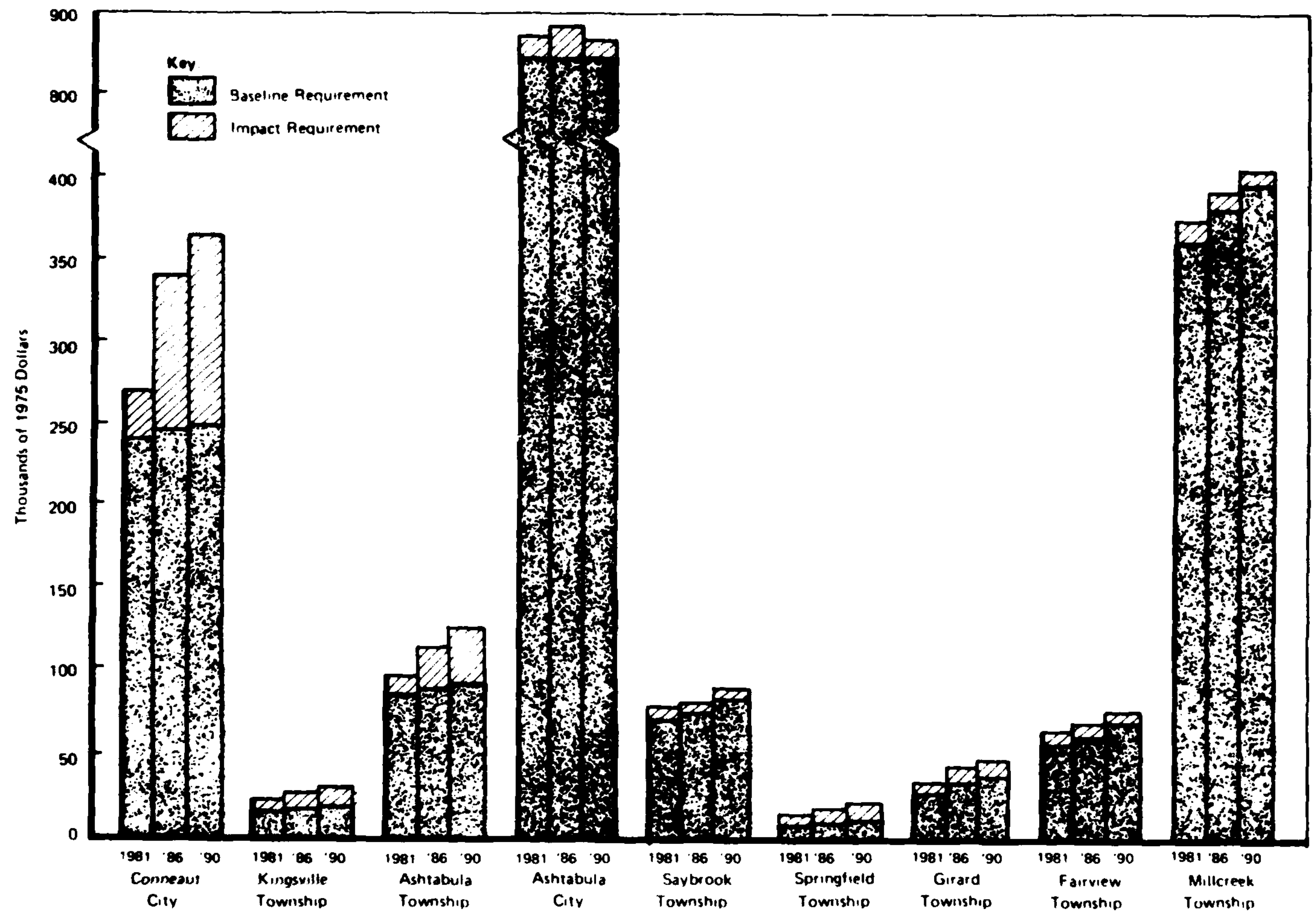

FIGURE 4–25 IMPACT ON GENERAL GOVERNMENT EXPENDITURES

Table 4-106

Impact on General Government Employment in the Local Study Area -- 1979-1990

	Full-Time Equivalent Employees			
	1979	1981	1986	1990
Ohio				
Conneaut City				
Construction-Related	0.0	0.6	0.3	0.0
Operations-Related	0.0	0.6	4.2	6.0
Total Impact	0.0	1.2	4.5	6.0
Baseline	11.7	11.8	12.1	12.3
Total Impact as a Percent of Baseline	0.0	10%	37%	49%
Pennsylvania				
Springfield Township[1]				
Construction-Related	0.0	0.1	0.0	0.0
Operations-Related	0.0	0.1	0.9	1.2
Total Impact	0.0	0.2	0.9	1.2
Baseline	0.6	0.6	0.7	0.7
Total Impact as a Percent of Baseline	0.0%	33%	129%	171%

(1) Assuming 80% of the Pennsylvania Local Area population will locate in the Springfield Township and 20% in East Springfield Borough, the approximate baseline distribution.

Sources: General Government baseline; General Government Working Paper; SIMPACT IV Model.

The general Government employment and expenditure requirements relative to the baseline need are expected to be unusually large compared to the increase in population. For example, by 1990, the population of Springfield resulting from development related to the U.S. Steel proposal is expected to equal about 70 percent of the baseline population, while projected general Government employment (and expenditure) requirements would equal more than 170 percent of baseline requirements. This difference is the result of certain assumptions in the estimating approach. In developing per capita coefficients to measure general Government employment impact, it was assumed that for those localities where the number of full-time equivalent general Government employees per capita was below the Statewide average in 1975, employment per capita would rise to the average level under impact conditions. However, no change was made in the 1975 coefficients in making baseline projections. For most coastal communities, this approach did not involve very large changes from baseline coefficients. However, for Springfield Township and East Springfield Borough, the changes were significant, with the coefficients increasing from baseline levels of 0.2 employees per 1,000 population to impact levels of 0.4 and 0.6, respectively. This approach was used because it was assumed that in an area with a very small number of public employees, a relatively large population increase occurring in a short time period would necessitate that the level of general Government services expand at a greater rate than the rise in population. General Government employment requirements expected for East Springfield Borough would be minimal. Assuming that 20 percent (the approximate baseline distribution) of the Pennsylvania Local Study Area impact population locates in East Springfield Borough, the general Government employment requirement would be zero through 1981, and 0.3 for 1986 and 1990, indicating a possible need for additional part-time clerical assistance.

Ohio Principal Study Area

4.264
General Government employment requirements for the coastal communities in the Ohio Principal Study Area are expected to be substantially lower than those for the Local Study Area, as shown in Tables 4-107 through 4-110. The maximum projected requirement is expected in Ashtabula Township and Ashtabula City where about one additional full-time equivalent employee would be needed for each in 1990. This would equal only three percent of the projected baseline employment for Ashtabula City, but 42 percent for the township (refer to Tables 4-108 and 4-109). Saybrook Township has the lowest projected incremental requirements for the projection period, varying between 0.1 and 0.2 full-time equivalent employees (refer to Table 4-110). These employment requirements indicate that all coastal communities in the Ohio Principal Study Area would need some part-time clerical

Table 4-107

Impact On General Government Requirements in Kingsville Township and North Kingsville Village -- 1979-1990[1]

Employment[2]	1979	1981	1986	1990
Construction-Related	0	0.2	0.1	0
Operations-Related	0	0.1	0.3	0.5
Total Impact	0	0.3	0.4	0.5
Baseline	0.6	0.6	0.6	0.7
Total Impact as a Percent of Baseline	0%	50%	67%	71%
Expenditures (in thousands of 1975 $)				
Construction-Related	$ 0.7	$ 4.8	$ 2.4	$ 0
Operations-Related	0	3.6	9.7	12.2
Total Impact	0.7	8.4	12.1	12.2
Baseline	14.5	14.9	15.9	16.8
Total Impact as a Percent of Baseline	5%	56%	76%	73%
Floor Space Requirements (Sq Ft)				
Construction-Related	11.9	80.3	39.5	0
Operations-Related	0	60.8	162.5	204.3
Total Impact	11.9	141.1	202.0	204.3
Construction Cost Requirements (in thousands of 1975 $)				
Construction-Related	$ 0.4	$ 2.8	$ 1.4	$ 0
Operations-Related	0	2.1	5.7	7.1
Total Impact	$ 0.4	$ 4.9	$ 7.1	$ 7.1

[1] Estimates for North Kingsville Village would be of a similar order of magnitude.

[2] Full-time equivalent.

Source: General Government baseline; General Government Working Paper; SIMPACT IV Model.

Table 4- 108

Impact On General Government Requirements in Ashtabula Township -- 1979-1990

Employment[1]	1979	1981	1986	1990
Construction-Related	0	0.1	0.1	0
Operations-Related	0	0.1	0.6	0.8
Total Impact	0	0.2	0.7	0.8
Baseline	1.7	1.8	1.8	1.9
Total Impact as a Percent of Baseline	0%	11%	39%	42%
Expenditures (in thousands of 1975 $)				
Construction-Related	$ 0	$ 4.7	$ 2.3	$ 0
Operations-Related	0	5.2	24.8	32.6
Total Impact	0	9.9	27.1	32.6
Baseline	77.3	78.2	80.5	83.0
Total Impact as a Percent of Baseline	0%	13%	34%	39%
Floor Space Requirements (Sq Ft)				
Construction-Related	0	48.4	23.5	0
Operations-Related	0	53.7	256.8	337.1
Total Impact	0	102.1	280.3	337.1
Construction Cost Requirements (in thousands of 1975 $)				
Construction-Related	$ 0	$ 1.7	$ 0.8	$ 0
Operations-Related	0	1.9	8.9	11.7
Total Impact	$ 0	$ 3.6	$ 9.7	$11.7

(1) Full-time equivalent.

Source: General Government baseline; General Government Working Paper; SIMPACT IV Model.

Table 4- 109

Impact On General Government Requirements in Ashtabula City -- 1979-1990

Employment[1]	1979	1981	1986	1990
Construction-Related	0	0.5	0.2	0
Operations-Related	0	0.1	0.5	0.8
Total Impact	0	0.6	0.7	0.8
Baseline	32.6	33.0	32.0	30.8
Total Impact as a Percent of Baseline	0%	2%	2%	3%
Expenditures (in thousands of 1975 $)				
Construction-Related	$ 0	$11.6	$ 5.8	$ 0
Operations-Related	0	1.5	12.4	18.3
Total Impact	0	13.1	18.2	18.3
Baseline	0	882.1	822.1	822.1
Total Impact as a Percent of Baseline	0%	2%	2%	2%
Floor Space Requirements (Sq Ft)				
Construction-Related	0	203.2	102.6	0
Operations-Related	0	25.8	218.0	321.2
Total Impact	0	229.0	320.6	321.2
Construction Cost Requirements (in thousands of 1975 $)				
Construction-Related	$ 0	$ 7.1	$ 3.6	$ 0
Operations-Related	0	0.9	7.5	11.1
Total Impact	$ 0	$ 8.0	$11.1	$11.1

(1) Full-time equivalent.

Source: General Government baseline; General Government Working Paper; SIMPACT IV Model.

Table 4- 110

Impact On General Government Requirements in Saybrook Township -- 1979-1990

Employment[1]	1979	1981	1986	1990
Construction-Related	0	0.1	0.1	0
Operations-Related	0	0.1	0.1	0.1
Total Impact	0	0.2	0.2	0.1
Baseline	0	2.5	2.7	2.9
Total Impact as a Percent of Baseline	0%	8%	7%	3%
Expenditures (in thousands of 1975 $)				
Construction-Related	$ 0.2	$ 3.4	$ 1.6	$ 0
Operations-Related	0	2.7	3.5	3.5
Total Impact	0.2	6.1	5.1	3.5
Baseline	67.6	69.9	75.9	81.4
Total Impact as a Percent of Baseline	0%	9%	7%	4%
Floor Space Requirements (Sq Ft)				
Construction-Related	3.5	52.0	24.0	0
Operations-Related	0	41.6	54.2	54.0
Total Impact	3.5	93.6	78.2	54.0
Construction Cost Requirements (in thousands of 1975 $)				
Construction-Related	$ 0.1	$ 1.8	$ 0.8	$ 0
Operations-Related	0	1.4	1.9	1.9
Total Impact	$ 0.1	$ 3.2	$ 2.7	$ 1.9

(1) Full-time equivalent

Source: General Government baseline; General Government Working Paper; SIMPACT IV Model.

assistance during the projection period to meet increased administrative work loads associated with the additional population. The employment requirement estimates for Kingsville Township and North Kingsville Village given in Table 4-107 are based on per capita coefficients for the township. Their use resulted in an estimate of 0.5 additional full-time equivalent employees by 1990. If coefficients for North Kingsville Village had been used as the basis for estimation, the requirement would be 1.3 full-time equivalent employees in 1990 resulting in greater impact than is indicated on Table 4-109. The difference in requirements between the village and the township reflects the differences in the factors for the number of fulltime equivalent employees per 1,000 population for each community, 0.4 for the township and 1.1 for the village. The eventual effect of mill-related development on general Government requirements in this area will depend on the division of new population between the township and the village, which at this time has not been estimated.

4.265
For Ashtabula County, requirements for about 14 additional full-time equivalent general Government employees are projected for 1990, which is equal to about 13 percent of baseline levels (refer to Table 4-111). General Government employment requirements for the county are substantially higher (in absolute terms) than for the coastal communities because of the broader range of general Government services provided at this level of Government (e.g., health, corrections, assessments of property, and election administration) and because the employment requirements are based upon the projected (baseline and impact) population increase for the entire county.

Pennsylvania Principal Study Area

4.266
Projected requirements for additional general Government employment are somewhat lower for coastal communities in the Pennsylvania Principal Study Area than those in its Ohio counterpart (refer to Tables 4-112 through 4-115. The largest projected incremental requirements are 0.6 fulltime equivalent employees in Girard Township in 1990, and 0.5 in Millcreek Township in 1981. Millcreek's maximum requirement is projected to occur earlier than in the other municipalities because its projected population peaks in 1981 as a result of the influx of a relatively larger number of construction employees. In most other coastal communities of the Pennsylvania Principal Study Area, the largest projected influx of new residents is associated with plant operations, and maximum population is reached in 1990. The Girard Township projected requirement is equal to about 30 percent of the baseline (refer to Table 4-112) while that of Millcreek is equal to only one percent (refer to Table 4-113). The projected employment requirements for Fairview Township and

Table 4-111

Impact On General Government Requirements in
Ashtabula County -- 1979-1990

Employment[1]	1979	1981	1986	1990
Construction-Related	0.2	3.4	1.7	0
Operations-Related	0	2.4	10.4	14.0
Total Impact	0.2	5.8	12.1	14.0
Baseline	99.4	99.7	102.4	104.3
Total Impact as a Percent of Baseline	0%	6%	12%	13%
Expenditures (in thousands of 1975 $)				
Construction-Related	$ 3.3	$50.8	$24.9	$ 0
Operations-Related	0	34.9	157.2	211.2
Total Impact	3.3	85.7	182.1	211.2
Baseline	1500.9	1511.5	1546.5	1575.1
Total Impact as a Percent of Baseline	0	6%	12%	13%
Floor Space Requirements (Sq Ft)				
Construction-Related	90.8	1429.8	702.1	0
Operations-Related	0	981.9	4420.7	5931.7
Total Impact	90.8	2411.7	5122.8	5931.7
Construction Cost Requirements (in thousands of 1975 $)				
Construction-Related	$ 3.2	$49.8	$24.4	$ 0
Operations-Related	0	34.2	153.7	206.7
Total Impact	$ 3.2	84.0	$178.1	$206.7

(1) Full-time equivalent.

Source: General Government baseline; General Government Working Paper: SIMPACT IV Model.

Table 4-112

Impact On General Government Requirements in the Girard Area -- 1979-1990

	1979	1981	1986	1990
Employment[1]				
Construction-Related	0	0.1	0.1	0
Operations-Related	0	0.1	0.4	0.6
Total Impact	0	0.2	0.5	0.6
Baseline	1.7	1.8	1.9	2.0
Total Impact as a Percent of Baseline	0%	11%	26%	30%
Expenditures (in thousands of 1975 $)				
Construction-Related	$ 0.1	$ 2.1	$ 1.0	$ 0
Operations-Related	0	1.7	7.1	9.4
Total Impact	0.1	3.8	8.1	9.4
Baseline	28.9	29.8	32.1	34.1
Total Impact as a Percent of Baseline	0%	13%	25%	28%
Floor Space Requirements (Sq Ft)				
Construction-Related	3.5	52.0	24.0	0
Operations-Related	0	43.6	179.3	238.4
Total Impact	3.5	95.6	203.3	238.4
Construction Cost Requirements (in thousands of 1975 $)				
Construction-Related	$ 0.1	$ 1.8	$ 0.8	$ 0
Operations-Related	0	1.5	6.2	8.3
Total Impact	$ 0.1	$ 3.3	$ 7.0	$ 8.3

(1) Full-time equivalent.

Source: General Government baseline; General Government Working Paper; SIMPACT IV Model.

Table 4-113

Impact On General Government Requirements in Fairview Township and Borough -- 1979-1990

Employment[1]	1979	1981	1986	1990
Construction-Related	0	0.2	0.1	0
Operations-Related	0	0.1	0.2	0.3
Total Impact	0	0.3	0.3	0.3
Baseline	3.1	3.2	3.5	3.7
Total Impact as a Percent of Baseline	3.1	3.2	3.5	3.7
Expenditures (in thousands of 1975 $)				
Construction-Related	$ 0.4	3.6	1.8	0
Operations-Related	0	1.7	3.9	4.4
Total Impact	0	5.3	5.7	4.4
Baseline	54.4	56.2	60.9	65.5
Total Impact as a Percent of Baseline	1%	9%	9%	7%
Floor Space Requirements (Sq Ft)				
Construction-Related	10.5	86.3	42.3	0
Operations-Related	0	40.7	94.1	106.0
Total Impact	10.5	127.0	136.4	106.0
Construction Cost Requirements (in thousands of 1975 $)				
Construction-Related	$ 0.4	$ 3.0	$ 1.5	$ 0
Operations-Related	0	1.4	3.3	3.7
Total Impact	$ 0	$ 4.4	$ 4.8	$ 3.7

(1) Full-time equivalent.

Source: General Government baseline; General Government Working Paper; SIMPACT IV Model.

Table 4-114

Impact On General Government Requirements in Millcreek Township -- 1979-1990

Employment[1]	1979	1981	1986	1990
Construction-Related	0	0.5	0.2	0
Operations-Related	0	0	0.1	0.2
Total Impact	0	0.5	0.3	0.2
Baseline	19.0	19.2	20.0	21.0
Total Impact as a Percent of Baseline	0%	3%	2%	1%
Expenditures (in thousands of 1975 $)				
Construction-Related	0.5	$ 8.4	$ 4.4	$ 0
Operations-Related	0	0.8	2.3	4.4
Total Impact	0.5	9.2	6.7	4.4
Baseline	355.3	360.0	380.8	392.3
Total Impact as a Percent of Baseline	0%	3%	1%	1%
Floor Space Requirements (Sq Ft)				
Construction-Related	10.3	191.5	99.0	0
Operations-Related	0	18.5	52.9	100.8
Total Impact	10.3	210.0	151.9	100.8
Construction Cost Requirements (in thousands of 1975 $)				
Construction-Related	$ 0.4	$ 6.7	$ 3.5	$ 0
Operations-Related	0	0.6	1.8	3.5
Total Impact	$ 0.4	$ 7.3	$ 5.3	$ 3.5

[1] Full-time equivalent.

Source: General Government baseline; General Government Working Paper; SIMPACT IV Model.

Table 4-115

Impact On General Government Requirements in
Erie County -- 1979-1990

Employment[1]	1979	1981	1986	1990
Construction-Related	0.3	4.6	2.2	0
Operations-Related	0	1.7	7.3	9.9
Total Impact	0.3	6.3	9.5	9.9
Baseline	464.5	467.6	483.5	496.5
Total Impact as a Percent of Baseline	0%	1%	2%	2%
Expenditures (in thousands of 1975 $)				
Construction-Related	$16.0	$220.2	$107.4	$ 0
Operations-Related	0	78.5	336.5	461.6
Total Impact	16.0	298.7	443.9	461.6
Baseline	21702.0	21948.0	22591.3	23199.9
Total Impact as a Percent of Baseline	0%	1%	2%	2%
Floor Space Requirements (Sq Ft)				
Construction-Related	146.2	1998.6	975.2	0
Operations-Related	0	711.6	3095.8	4155.3
Total Impact	146.2	2710.2	4071.0	4155.3
Construction Cost Requirements (in thousands of 1975 $)				
Construction-Related	$ 5.1	$69.6	$33.9	$ 0
Operations-Related	0	24.8	106.5	146.1
Total Impact	$ 5.1	$94.4	$140.4	$146.1

(1) Full-time equivalent.

Source: General Government Baseline; General Government Working Paper; SIMPACT IV Model.

Borough and the Girard Area (Girard Township, Girard Borough, Lake City Borough, and Platea Borough) are based on coefficients of employees per 1,000 population for the township. These coefficients yielded estimates of 0.3 and 0.6 additional full-time equivalent employees by 1990 in Fairview and Girard, respectively. If the borough coefficients had been used as the basis for estimation, the requirements by 1990 would have been nearly one full-time equivalent employee in Girard and 0.3 in Fairview, the same as for the township. The requirements are higher for the boroughs, because of larger coefficients. As was noted for the Kingsville area, the eventual impact will depend on the division of future population increases between the township and borough, which has not been estimated in this report.

4.267
For Erie County General Government, projected requirements for employment additions are nearly 10 in 1990 which is equal to about two percent of baseline levels (refer to Table 115). For the same reasons as in Ashtabula County, the general Government employment requirements for Erie County are higher (in absolute terms) than those for the Coastal Communities.

b) General Government Operating Expenditures

Ohio Local Study Area

4.268
Since general Government operating expenditure requirements are estimated on a per employee basis, they generally follow the same pattern as the employment requirements. During the construction of the proposed facility, the anticipated impact on Conneaut is relatively small since the projected additional general Government employment requirement is also small. In 1981 when construction activity reaches a maximum, the projected additional expenditure requirements in Conneaut are nearly $24,000, which is equal to 10 percent of projected baseline expenditure levels (refer to Table 4-116). By 1990, expenditure requirements would be about $120,000 or 48 percent of baseline expenditure levels. In addition to personnel costs, these additional expenditure requirements would likely include materials and supplies as well as small equipment costs to support the administrative and financial record-keeping work effort.

Pennsylvania Local Study Area

4.269
The Pennsylvania Local Study Area is expected to experience a major increase in general Government expenditure requirements over baseline levels. Additional expenditure requirements for Springfield Township

Table 4-116

Impact on General Government Operating Expenditures in the Local Study Area -- 1979-1990
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Conneaut City				
Construction-Related	$ 0.6	$ 11.6	$ 5.7	$ 0
Operations-Related	0	12.3	85.3	120.8
Total Impact	0.6	23.9	91.0	120.8
Baseline	238.1	240.3	245.7	250.1
Total Impact as a Percent of Baseline	0%	10%	37%	48%
Springfield Township[1]				
Construction-Related	$ 0	$ 0.8	$ 0.3	$ 0
Operations-Related	0	1.8	12.6	16.0
Total Impact	0	2.6	12.9	16.0
Baseline	10.8	9.0	12.1	12.7
Total Impact as a Percent of Baseline	0%	29%	107%	126%

(1) Assumes 80% of Pennsylvania Local Study Area population will locate in Springfield Township and 20% in East Springfield Borough, the approximate baseline distribution.

Source: General Government baseline; General Government Working Paper; SIMPACT IV, Model.

are projected to reach nearly $16,000 in 1990 (refer to Table 4-116). This increase is equivalent to 126 percent of projected baseline expenditure levels, or nearly the same percentage increase as employment. Thus, most of these additional expenditures would probably be employee related. Springfield's supplies and office equipment needs would be small compared to those of Conneaut since its population would still be at a level where the administrative and clerical workload would not require the degree of mechanization that would be necessary in a larger community. The projected expenditure requirements for East Springfield Borough are only $2,000 in 1981 or about 40 percent of the baseline amount. By 1990, it is projected to increase to about $10,000 or double the baseline amount.

Ohio Principal Study Area

4.270
Requirements for additional general Government expenditures would vary among the local Governments of the Ohio Coastal Communities, both in absolute terms and relative to the baseline. In addition to different employment impacts, variations in expenditure requirements reflect substantial differences among the communities in current levels of expenditures per employee from which the incremental requirements were projected. The incremental rise in general Government expenditures is projected to be greatest in Ashtabula Township where they are estimated at $33,000 in 1990 representing nearly 42 percent of the projected baseline expenditure level (refer to Table 4-108). Relative incremental expenditure requirements are projected to be highest in Kingsville where the low baseline level tends to magnify the significance of the impact (refer to Table 4-107). In 1986, the additional projected expenditures equal $12,000 or 73 percent of baseline requirements of $16,800. For Ashtabula County, projected additional general Government expenditure requirements reach $211,000 in 1990, which is larger than the total for all the coastal communities, but equal to only 13 percent of its baseline level (refer to Table 4-111).

Pennsylvania Principal Study Area

4.271
General Government expenditures for municipal Governments in the Pennsylvania Coastal Communities are expected to vary in the same manner and for the same reasons as do those for their counterparts in Ohio. Projected additions to general Government expenditure are highest in Girard Township, where they amount to over $9,000 in 1990. This is equal to 27 percent of projected baseline levels (refer to Table 4-114). General Government expenditures for Erie County would be much higher than for the municipalities, projected at about $460,000 in 1990, but only two percent of the baseline amount.

c) Space Requirements and Construction Costs

Ohio Local Study Area

4.272
The projected number of additional general Government employees required in Conneaut would create a need for nearly 500 square feet of space in 1981, nearly 1,900 by 1986 and 2,500 by 1990. This increase is relatively small and would probably not require the construction of new facilities (refer to Table 4-117). Expenditures may be required for minor renovations in City Hall to provide the additional office space. One possible means of increasing office space in City Hall would be to use the space currently occupied by the police department if a new police station were built. If the additional space were not available within City Hall, some consolidation of existing space (installation of partitions, etc.) would likely be necessary with a corresponding reduction in the current space per employee. For 1990, the year of projected maximum requirements, the projected cost for this additional space is about 8,000 (estimated on a construction cost per square foot basis).

Pennsylvania Local Study Area

4.273
Filling the projected additional general Government employment requirements in Springfield Township would create a need for nearly 500 feet of new office space by 1990 (refer to Table 4-117). This space requirement is small, however, and could be met in the existing township building. Since the expected employment requirements in Springfield Township represent a need mostly for additional part-time assistance, low-cost modifications might be made to the existing town building to provide the required space, thus avoiding the need for adding new floor space as indicated on Table 4-117.

Ohio Principal Study Area

4.274
Projected office space requirements for the additional general Government employee and associated construction costs are small for all coastal communities in the Ohio Principal Study Area. Space needs would likely be met by existing facilities, requiring at the most minimal modifications to existing municipal buildings. Ashtabula Township exhibits the greatest floor space need requiring about 400 square feet in 1990 (refer to Table 4-108). The municipal space additions are so small that the expenditure requirements indicated on Tables 4-107 through 4-110 would probably not be incurred. Ashtabula County General Government needs are more substantial, with about 5,900 square feet required in 1990. This new area could likely

Table 4-117

Projected Impact on Floor Space and Construction Cost Requirements for General Government in the Local Study Area -- 1975-1990

	Sq. Ft. of Floor Space				Construction Cost (Thousands of 1975 $)			
	1979	1981	1986	1990	1979	1981	1986	1990
Conneaut City								
Construction-Related	13	242	119	0	$0	$ 8	$ 4	$ 0
Operation-Related	0	256	1787	2521	0	9	62	88
Total Impact	13	498	1906	2521	$0	$17	$66	$88
Springfield Township								
Construction-Related	0	24	10	0	$0	$1	$ 0	$ 0
Operation-Related	0	54	388	492	0	2	14	17
Total Impact	0	78	398	492	$0	$3	$14	$17

Source: General Government baseline; General Government Working Paper; SIMPACT IV Model.

be met without a major construction effort by more intensive utilization of existing county office building facilities. This may necessitate some minor building modifications which could reduce the amount of floor space per employee.

Pennsylvania Principal Study Area

4.275
As in Ohio, projected additional floor space requirements in the coastal communities of the Pennsylvania Study Area are small. The additional space could be met by existing facilities requiring, at most, minor building modifications. Since the space requirements are small and would probably be met in existing facilities, the construction costs indicated on Tables 4-112 through 4-115 would probably not be incurred. Additional floor space needs are highest for Erie County Government with nearly 4,200 square feet required in 1990. These requirements could likely be met in the County Courthouse Building which has recently been expanded. The estimated costs of the additional space would be $145,200. However, because of the recent expansion of the County Courthouse, the cost of building modifications to accommodate the additional general Government employees would likely be much less.

Tax Revenues and Public Expenditures

a) Summary

Local Study Area

4.276
Lower property tax rates and reductions in local income taxes would be possible considering the assessed valuation added by the proposed plant and the income tax revenues generated by facility employees. The property tax rates for the taxing jurisdictions in the Local Study Area show substantial year to year fluctuations during the impact projection period. This is the result of discrete estimates for each year of analysis. However, it is reasonable to assume that a fiscal policy would be pursued under which the tax rate changes would occur gradually. Conneaut City could reduce its property tax rates substantially as a result of impact-related development (refer to Table 4-118). In 1986, the tax rate could be an estimated $0.20 per thousand of assessed valuation or a 96 percent reduction from the projected baseline rate. This rate reduction would result from the addition of an estimated $107 million of assessed valuation of Lakefront facility property to the city's property tax base, and from receipt of an estimated $727,000 in income tax revenues from Lakefront facility employees. Alternatively, the city could choose to reduce its income tax rate and make a smaller reduction in the

Table 4-118

Impact on Property Tax Rates in Conneaut City -- 1979-1990[1]

	Baseline Tax Rate	Impact Tax Rate	Percent Reduction from Baseline
1979	$ 5.70	$ 4.80	16%
1980	5.70	3.00	47
1981	5.70	0.80	86
1982	5.70	2.90	49
1983	5.70	1.30	77
1984	5.70	1.30	77
1985	5.70	0.40	93
1986	5.70	0.20	96
1987	5.70	1.10	81
1988	5.70	0.70	88
1989	5.70	0.80	86
1990	5.70	0.90	84

[1] Rates are expressed in dollars per thousand of assessed valuation.

Source: Table 4-151.

property tax rate. In that case, U.S. Steel's property taxes would constitute a larger portion of the city's total property tax revenues and total operating revenues.

4.277
Springfield Township could eliminate its property tax (projected baseline rate of $2.20 per thousand of assessed valuation) as a result of the Lakefront plant development. The income tax revenues from employees of the Lakefront facility in Springfield would be so large (estimated at over $400,000 by 1985) that the township's revenues from this source alone would greatly exceed its expenditure requirements. For most years of the projection period, the township could even reduce its income tax rate by half, and still have no need for property tax revenues. Alternatively, the township could eliminate its income tax. In that case, the property tax rate would increase beyond the projected baseline rate, and taxpayers in the township would have no income tax but higher property taxes.

4.278
The largest tax rate reduction of any taxing jurisdiction in the Local Study Area could occur in the Conneaut Area City School District. The range of tax rate reductions for the District could reach about $9.00 (1988) which would be a 38 percent reduction from the projected baseline rate of $23.20 (refer to Table 4-119). The tax rate reductions would be the direct result of the addition of the assessed valuation of the Lakefront facility to the tax base. In 1986, the assessed valuation of Lakefront facility property in the District would be equal to more than 2.5 times the projected baseline assessed valuation. With the addition of Lakefront facility property to the tax base, U.S. Steel's property taxes for the Lakefront facility ($2.7 million in 1990) would constitute over 60 percent of the District's total property tax revenues and about half of its total operating revenues.

4.279
The Northwestern School District could also reduce its property tax rate substantially as a result of the addition of the valuation of Lakefront facility property to its tax base. The reductions would not, however, be as significant as in the Conneaut School District (refer to Table 4-120). Machinery, equipment, and inventories at the Lakefront facility would not be taxable in Pennsylvania as they would in Ohio, so the assessed valuation of the Lakefront facility would be substantially lower in the Northwestern District than in Conneaut. In 1990, the facility's estimated valuation in Northwestern would be $25 million (well below the $174 million in Conneaut) and would result in a tax rate of $52.50 or 14 percent below the projected baseline rate. Property taxes paid by U.S. Steel on its Lakefront facility would be an estimated $1.3 million in 1990 which would equal

Table 4-119

Impact on School District Property Tax Rates in the Conneaut Area City School District -- 1979-1990[1]

	Baseline Tax Rate	Impact Tax Rate	Percent Reduction (Increase) from Baseline
1979	$ 30.30	$ 30.10	0.3%
1980	29.10	29.70	(3)
1981	28.30	31.80	(12)
1982	27.30	22.60	17
1983	26.30	15.90	40
1984	25.40	17.50	31
1985	24.60	17.90	27
1986	23.70	19.90	16
1987	23.50	18.80	20
1988	23.20	14.40	38
1989	22.90	15.00	34
1990	22.40	15.60	30

(1) Rates are expressed in 1975 dollars per thousand of assessed valuation.

Source: Table 4-153.

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FINAL ENVIRONMENTAL IMPACT STATEMENT. PERMIT APPLICATION BY UNI--ETC(U)
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Table 4-120

Impact on School District Property Tax Rates in the Northwestern School District -- 1979-1990[1]

	Baseline Tax Rate	Impact Tax Rate	Percent Reduction from Baseline
1979	$ 69.50	$ 68.40	2%
1980	68.00	66.20	3
1981	66.10	38.60	41
1982	64.90	39.70	39
1983	64.00	52.10	19
1984	62.90	51.70	18
1985	61.00	50.70	17
1986	61.60	44.70	27
1987	61.20	51.40	16
1988	61.10	52.30	14
1989	60.60	51.90	14
1990	61.10	52.50	14

(1) Rates are expressed in dollars per thousand of assessed valuation.

Source: Table 4-167.

53 percent of the District's total property tax revenues and 30 percent of its total operating revenues. The combined reductions in property tax rates at the county, municipal and school district levels could result in significant savings to property owners. For example, in 1990, the owner of a $40,000 home in Conneaut could save $177 in property taxes - $67 in city taxes, $96 in school district taxes and $14 in county taxes (refer to Table 4-121). For the owner of a $40,000 home in Springfield, the savings would be $89.

Principal Study Area

4.280
Plant-related development would have little effect on the tax rates of municipalities in the Principal Study Area. For most municipalities the property tax and income tax revenues from impact-related development would be sufficient to cover the expenditure requirements so that no property tax rate increase would be necessary. Plant induced development could result in the need for property tax rate increases in the Principal Study Area's school districts. The largest increase would occur in the Buckeye School District where a $2.40 rate increase (12 percent above the baseline rate) would be needed to meet the impact-related expenditure requirements in 1990. The rate increases result from impact-related expenditure requirements, which are estimated on the basis of an average cost of $1,250 per pupil (for most districts). Since the impact-related property and income tax revenues are well below that amount using baseline tax rates, the property tax rate must increase to meet the expenditure requirements.

Regional Study Area

4.281
Both Ashtabula and Erie Counties could reduce their property tax rates as a result of plant induced development, but not nearly as much as the Local Study Area municipalities and school districts. In 1990, the addition of the assessed valuation of Lakefront facility property to the tax bases of each county results in an estimated rate of $2.80 in Ashtabula County in 1990 or a reduction of $1.00 or 26 percent from the projected baseline rate ($3.80), and $12 in Erie County in 1990, a rate reduction of $0.20 or two percent from the projected baseline rate ($12.20).

b) State Taxes

4.282
Ohio and Pennsylvania State tax revenues from impact-related development would be small. In 1990, the year of maximum impact, additional tax revenues would amount to $3.2 million in Ohio and $3.4 million in

Table 4-121

Impact on Property Taxes for a $40,000 Home -- 1990[1]

	Tax Under Baseline Conditions	Tax Under Impact Conditions	Tax Reduction
Ohio Local Study Area[2]			
Conneaut City	$ 80	$ 13	$ 67
Conneaut Area City School District	314	218	96
Ashtabula County	53	39	14
Total	$ 447	$ 270	$ 177
Pennsylvania Local Study Area[3]			
Springfield Township	$ 18	$ 0	$ 18
Northwestern School District	489	420	69
Erie County	98	96	2
Total	$ 605	$ 516	$ 89

(1) Assumes maximum property tax rate reduction case.

(2) Assumes an assessment ratio of 35%.

(3) Assumes an assessment ratio of 20%.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Pennsylvania, which would equal only 0.1 percent of total baseline State tax revenues for both States. The largest source of tax revenue in Ohio and Pennsylvania would be the sales tax, as shown in Tables 4-122 and 4-123, respectively. The estimated corporation income tax revenues exclude the corporation taxes that U.S. Steel would pay on the net income from the Lakefront facility. Revenues from this source would depend on U.S. Steel's total net income which has not been estimated herein. State motor fuel taxes were estimated on the basis of truck and passenger car miles traveled in the Regional Study Area. Each State, however, would also receive motor fuel tax revenue based on the miles driven outside the Study Area. In addition, Ohio imposes a highway use tax.

c) Impact on Local Government and School District Finances

Governmental Expenditure Requirements

4.283
The addition of new residents into the coastal communities would increase expenditure requirements for local Governments and school districts. Law enforcement, fire protection, and general Government expenditure requirements are estimated on the basis of the projected cost per additional employee. Employment requirements are estimated on the basis of the projected number of employees per 1,000 new residents. Education expenditures are estimated on the basis of the expected cost per impact-related pupil. Park maintenance expenditures are estimated by applying the cost per acre to the projected park acreage requirements. Construction and maintenance costs for storm sewers and local streets are estimated on the basis of cost per mile of new and improved local streets.

4.284
Impact-related expenditure requirements are shown for local Governments and school districts in the coastal communities for the four most significant years of the projection period. To illustrate their relative significance, impact-related expenditure requirements are compared to projected baseline expenditure estimates. Later subsections analyze the expenditure requirements of each taxing jurisdiction in the coastal communities in light of available revenues and possible effects on local tax rates. The expenditures discussed here include only those that would be financed from tax revenues such as education, law enforcement, fire protection, road maintenance (including storm sewers), park maintenance, general Government and debt service. Construction and operation of sanitary sewer facilities and water facilities are assumed to be financed from user charges although under impact conditions Conneaut and Springfield could elect to finance these requirements with tax revenues rather than user charges. Solid waste disposal services are expected to be

Table 4-122

Impact on Ohio State Tax Revenues -- 1979-1990
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Construction				
Sales	$ 141	$ 591	$ 434	$ 0
Personal Income (1)	18	124	63	0
Corporation Income (1)	25	97	73	0
Motor Fuel	17	113	52	0
Other Taxes	7	109	54	0
Total	$ 208	$1,034	$ 676	$ 0
Operations				
Sales	$ 0	$ 228	$1,019	$1,557
Personal Income (1)	0	110	421	559
Corporation Income (1)	0	43	257	400
Motor Fuel	0	43	164	204
Other Taxes	0	75	336	451
Total	$ 0	$ 449	$2,197	$3,171
Total				
Sales	$ 141	$ 819	$1,453	$1,557
Personal Income (1)	18	234	484	559
Corporation Income (1)	25	140	330	400
Motor Fuel	17	156	216	204
Other Taxes	7	184	390	451
Total	$ 208	$1,533	$2,873	$3,171
Baseline	$2,765,000	$2,826,000	$3,001,000	$3,154,000
Total as a Percent of Baseline	(2)	0.1%	0.1%	0.1%

(1) Excludes tax revenues from United States Steel Corporation.

(2) Less than 0.05%

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-123

Impact on Pennsylvania State Tax Revenues -- 1979-1990
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Construction				
Sales	$ 189	$ 812	$ 593	$ 0
Personal Income (1)	35	244	116	0
Corporation Income (1)	36	188	136	0
Motor Fuels	62	298	137	0
Other	11	143	68	0
Total	$ 333	$1,685	$1,050	$ 0
Operations				
Sales	$ 0	$ 302	$1,230	$1,835
Personal Income (1)	0	124	502	657
Corporation Income (1)	0	51	254	387
Motor Fuels	0	70	323	257
Other	0	52	227	312
Total	$ 0	$ 599	$2,536	$3,448
Total				
Sales	$ 189	$1,114	$1,823	$1,835
Personal Income (1)	35	368	618	657
Corporation Income (1)	36	239	390	387
Motor Fuels	62	368	460	257
Other	11	195	295	312
Total	$ 333	$2,284	$3,586	$3,448
Baseline	$4,009,000	$4,063,000	$4,144,000	$4,219,000
Impact as a Percent of Baseline	(2)	0.1%	0.1%	0.1%

(1) Excludes tax revenues from United States Steel Corporation.

(2) Less than 0.05%

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

supplied by the private sector as is currently the case in the study area, so no local Government expenditures would be required.

4.285
Annual debt service costs are estimated on the basis of the amortization of the construction costs of plant-related public sector facilities. With the exception of roads and storm sewers, construction requirements are limited almost exclusively to the Local Study Area. Debt service costs would constitute a significant portion of expenditure requirements for school districts in the Local Study Area. Thus, the time period for which debt service costs are incurred becomes important in relating expenditure requirements to available revenues. The debt service schedules presented in this section are based on the dates construction of facilities would be necessary to meet the service requirement. A community could postpone construction of certain facilities until sufficient revenues are available, thus incurring debt service costs later in the projection period. Since annual street and storm sewer construction requirements are estimated to be relatively small, they are not amortized but rather are added in with the street and storm sewer maintenance costs.

Ohio Local Study Area

4.286
In the Local Study Area, expenditure requirements resulting from plant-related development would be highest in the Ohio Local Study Area (refer to Figure 4-26). Expenditure requirements for Conneaut City would be relatively low during the construction period (an estimated $4,000 in 1979 and $166,000 in 1981) but would increase substantially after the beginning of plant operations, estimated to amount to over $400,000 annually during the period 1986 through 1990 (refer to Table 4-124). By 1990, the year of maximum impact, the projected plant induced expenditure requirements of $477,000 would represent an increase of nearly 29 percent over projected baseline expenditures. The largest portion of Conneaut's additional expenditure requirements (29 percent) would be attributable to law enforcement costs (refer to Figure 4-27). Debt service costs for 1990 would include the amortized cost for construction of a new police station (1981), and a new fire station (1980), and for purchase of an aerial ladder fire truck (1987) and expansion of general Government facilities (1983) as shown in Table 4-125). Expenditure requirements resulting from construction-related activity would be about $40,000 in 1981, the year of greatest construction impact. The Conneaut Area City School District would have the largest absolute and relative increase in expenditure requirements of any taxing jurisdiction in the study area. By 1990, expenditure requirements would increase by an estimated $1.9 million, 57 percent

Table 4-124

Impact on Operating Expenditure Requirements in Conneaut City -- 1979-1990 (Thousands of 1975 Dollars)

	1979	1981	1986	1990
Construction				
Law Enforcement	$ 0.6	$ 12.0	$ 6.3	$ 0
Fire Protection	0.6	11.1	5.5	0
General Government	0.6	11.6	5.7	0
Maintenance and Construction of Local Streets(1)	0.5	0.5	0.5	0
Maintenance of Storm Sewers(1)	2.0	2.8	0	0
Park Maintenance	0.1	2.3	1.1	0
Total Expenditures(2)	$ 4.4	$ 40.3	$ 19.1	$ 0
Operations				
Law Enforcement	$ 0	$ 18.7	$ 105.7	$ 138.7
Fire Protection	0	11.8	81.8	115.9
General Government	0	12.3	85.3	120.8
Maintenance and Construction of Local Streets(1)	0	6.6	14.9	14.1
Maintenance of Storm Sewers(1)	0	26.3	27.5	3.4
Park Maintenance	0	2.5	17.0	24.1
Total Expenditures(2)	$ 0	$ 78.2	$ 332.2	$ 417.0
Total				
Law Enforcement	$ 0.6	$ 30.7	$ 112.0	$ 138.7
Fire Protection	0.6	22.9	87.3	115.9
General Government	0.6	23.9	91.0	120.8
Maintenance and Construction of Local Streets(1)	0.5	7.1	15.4	14.1
Maintenance of Storm Sewers(1)	2.0	29.1	27.5	3.4
Park Maintenance	0.1	4.8	18.1	24.1
Debt Service(3)	0	47.0	49.3	60.3
Total Expenditures(2)	$ 4.4	$ 165.5	$ 400.6	$ 477.3
Baseline(4)	$1,571.1	$1,586.8	$1,627.8	$1,657.1
Total Expenditures as a Percent of Baseline	*	10%	25%	29%

(1) Includes construction costs which are assumed to be small enough to be financed from current revenues rather than from issuance of debt.

(2) Excludes expenditures for maintenance and operation of sewer and water facilities. These expenditures are assumed to be financed out of user charges rather than tax revenues, and are discussed in their respective impact chapters.

(3) Debt service costs are not allocated between operations and construction.

(4) Baseline expenditures are assumed to be equal to baseline revenues (see State and Local Tax structure baseline).

* Less than 0.5%.

Source: *State and Local Tax Structure* baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-125

Impact on Construction of Public Infrastructure Facilities[(1)]

Jurisdiction	Facility Requirements	Construction Year	Construction[(2)] (Thousands of 1975 Dollars)
Conneaut City	Police Station	1981	$ 95[(3)]
Conneaut City	Fire Station (including pumper, staff car and communication equipment)	1980	410 88
Conneaut City	Aerial ladder fire truck	1987	165
Conneaut City	Renovation or modification of city hall	1983	88
Conneaut Area City School District	Addition to senior high school	1981	1,500
Conneaut Area City School District	Addition to junior high school	1985	830
Conneaut Area City School District	New Elementary School	1986	2,700
Northwestern School District	Elementary School Addition	1986	1,350
Erie County	Vocational School Addition	1981	490[(4)]
Ashtabula Township	One-pumper Fire Truck	1985	55
Ashtabula City	One-pumper Fire Truck	1985	55
Springfield Township/East Springfield Borough	Police Station	1980	155

(1) Excludes water and sewer facilities.

(2) Includes only those facilities assumed to be financed by issuance of bonded debt.

(3) The total cost of the facility would be an estimated $345,000. The portion attributable to impact population would be $95,000 - the remainder would be attributable to the baseline population.

(4) Would be offset by a 75% federal/state subsidy.

Source: SIMPACT IV Model: Law Enforcement, Fire Protection, Education Services, and General Government impact sections.

above projected baseline expenditures (refer to Table 4-126). Debt service costs would constitute a significant portion of this amount ($419,000) and would result from the need to construct an addition to the senior high school in 1981, an addition to the junior high school in 1985 and a new elementary school in 1986 (refer to Table 4-125).

Pennsylvania Local Study Area

4.287
For Springfield Township and East Springfield Borough, plant-related expenditure requirements would be considerably lower than in Conneaut City, but more significant in relation to estimated baseline expenditures (refer to Figure 4-26). In 1986, the year of maximum impact, expenditure requirements would be an estimated $193,000. Although far lower than the $400,000 in Conneaut for that year, this amount would represent an increase of about 125 percent over the projected baseline expenditures (refer to Table 4-127). Expenditure requirements are highest in 1986 because purchase of a fire truck ($50,000) would be required. As in Conneaut, the annual expenditure requirements resulting from the Lakefront facility construction would be small estimated at $6,000 in 1981. The Springfield area is expected to receive a smaller portion of the construction workers as new residents than would many of the other coastal communities. Law enforcement would account for the largest share of Springfield's expenditure requirements (54 percent) (refer to Figure 4-27). Fire protection operating costs would be relatively lower representing only five percent of the total in 1990 as compared to 24 percent in Conneaut. These estimates exclude expenditures that would be financed out of revenues from the annual carnival. Debt service costs, about eight percent of total expenditure requirements, would result from the cost of constructing a police station in 1980 (refer to Table 4-125). Expenditure requirements for the Northwestern School District are estimated to be nearly $1 million in 1990 -- an increase of nearly 30 percent over baseline expenditures (refer to Table 4-126). Debt service costs would equal about 12 percent of this total amount and would result from the cost of constructing an elementary school addition in 1986 (refer to Table 4-125 and Figure 4-27).

Principal Study Area

4.288
Total expenditures by type for local Governments and school districts in the Principal Study Area Coastal Communities are shown in Tables 4-128 and 4-129 while the totals from both are presented in Table 4-130. Plant-related expenditure requirements for municipalities and school districts in the Principal Study Area are far lower than those in the Local Study Area (refer to Table 4-130 and Figure 4-28). The

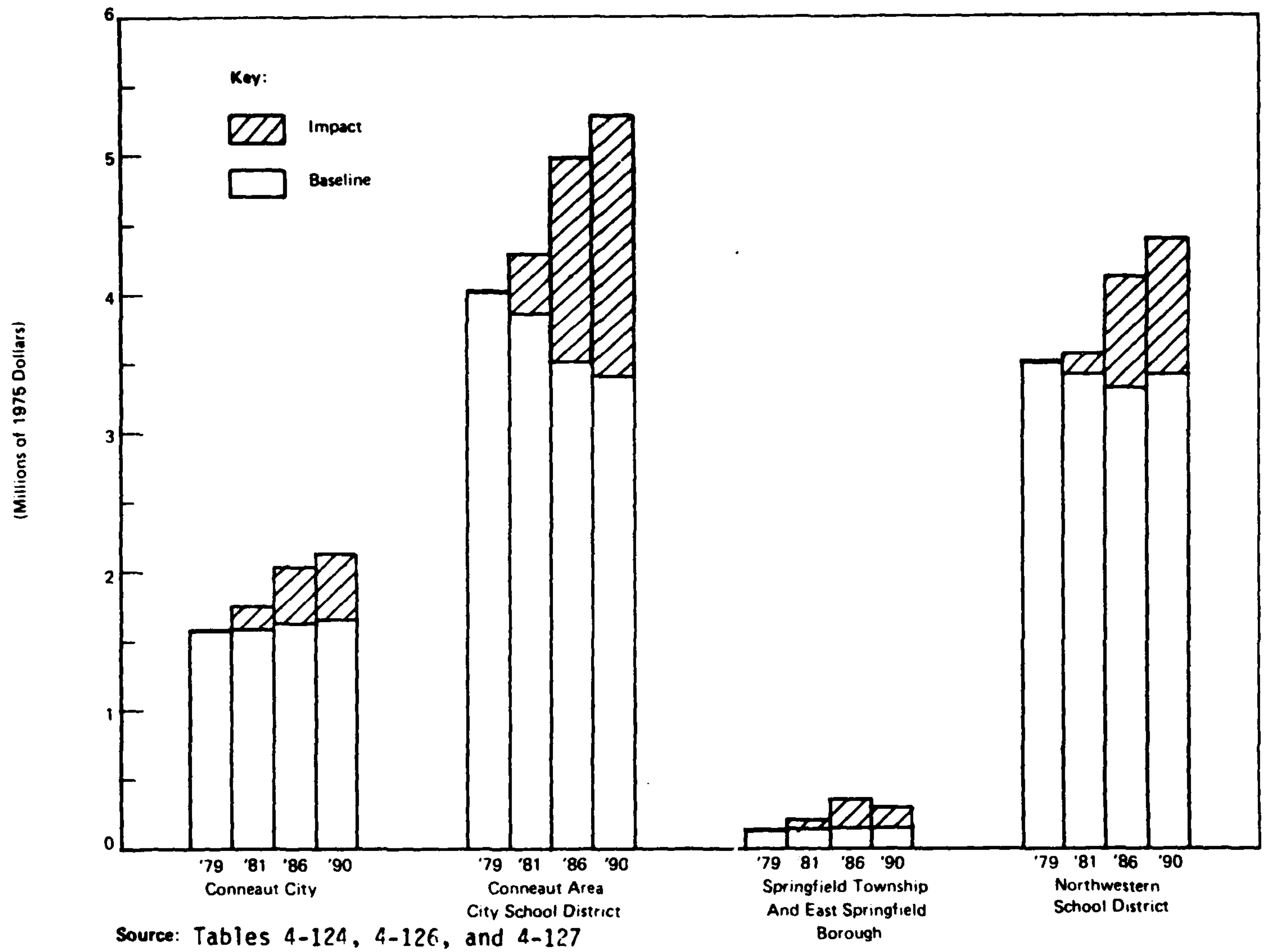
Table 4-126

Impact on School District Expenditures
in the Local Study Area -- 1979-1990
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Conneaut Area City School District				
Operating Expenditures	$ 6	$ 287	$1,092	$1,528
Debt Service	0	143	464	419
Total Expenditures	$ 6	$ 430	$1,556	$1,947
Baseline	$4,015	$3,854	$3,501	$3,413
Total Expenditures as a Percent of Baseline	*	11%	44%	57%
Northwestern School District				
Operating Expenditures	$ 0	$ 161	$ 681	$ 864
Debt Service	0	0	128	116
Total Expenditures	$ 0	$ 161	$ 809	$ 980
Baseline	$3,517	$3,407	$3,310	$3,412
Total Expenditures as a Percent of Baseline	0	5%	24%	29%

*Less than 0.5%.

Source: Education Services baseline; SIMPACT IV Model.



Source: Tables 4-124, 4-126, and 4-127

FIGURE 4–26 PLANT-RELATED IMPACT ON EXPENDITURE REQUIREMENTS IN THE LOCAL STUDY AREA

Table 4-127

Impact on Operating Expenditure Requirements in Springfield Township and East Springfield Borough -- 1979-1990 (Thousands of 1975 Dollars)

	1979	1981	1986	1990
Construction				
Law Enforcement	$ 0	$ 3.2	$ 1.3	$ 0
Fire Protection	0	0.3	0.1	0
General Government	0	1.0	0.4	0
Maintenance and Construction of Local Streets[1]	0	0.8	0.3	0
Maintenance and Construction of Storm Sewers[1]	0	0	0.6	0
Park Maintenance	0	0.5	0.2	0
Total Expenditures[2]	$ 0	$ 5.8	$ 2.9	$ 0
Operations				
Law Enforcement	$ 0	$ 19.2	$ 56.8	$ 75.7
Fire Protection	0	0.7	5.4	6.4
General Government	0	2.2	15.7	20.0
Maintenance and tonstruction of Local Streets[1]	0	6.2	15.8	12.2
Maintenance and Construction of Storm Sewers[1]	0	14.9	20.1	2.0
Park Maintenance	0	1.2	8.3	10.6
Total Expenditures[2]	$ 0	$ 44.4	$122.1	$126.9
Total				
Law Enforcement	$ 0	$ 22.4	$ 58.1	$ 75.7
Fire Protection	0	1.0	60.5[5]	6.5
General Government	0	3.2	16.1	20.0
Maintenance and Construction of Local Streets[1]	0	7.0	16.1	12.2
Maintenance and Construction of Storm Sewers[1]	0	14.9	20.7	2.0
Park Maintenance	0	1.7	8.5	10.6
Debt Service[3]	0	14.7	12.7	11.3
Total Expenditures[2]	$ 0	$ 64.9	$192.7	$138.2
Baseline[4]	$138.7	$141.4	$154.5	$162.8
Total Expenditures as a Percent of Baseline	0	46%	125%	85%

(1) Includes construction costs which are assumed to be small enough to be financed from current revenues rather than from issuance of debt.

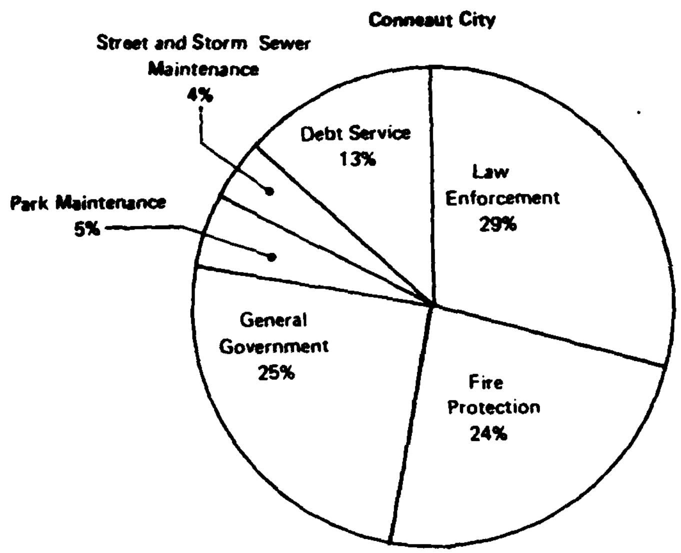
(2) Excludes expenditures for maintenance and operation of sewer and water facilities. These expenditures are assumed to be financed out of user charges rather than tax revenues, and are discussed in their respective impact chapters.

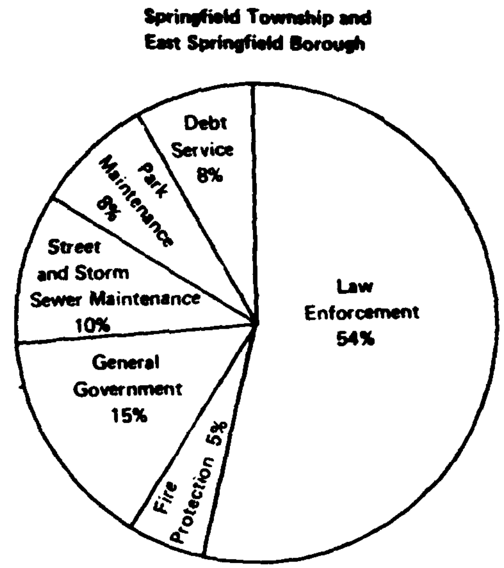
(3) Debt service costs are not allocated between operations and construction.

(4) Baseline expenditures are assumed to be equal to baseline revenues (see State and Local Tax Structure baseline section.)

(5) Includes purchase of a fire engine at a cost of $55,000

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.





Source: Table 4-124 and 4-125

FIGURE 4–27 CONNEAUT AND SPRINGFIELD EXPENDITURE REQUIREMENTS BY TYPE – 1990

Table 4-128

Impact on Operating Expenditure Requirements of Municipalities in the Coastal Communities -- 1979-1990 (Thousands of 1975 Dollars)

Kingsville Township and North Kingsville Village	1979	1981	1986	1990
Law Enforcement	$ 0	$ 15.0	$ 15.0	$ 15.0
Fire Protection	0.6	7.5	10.7	10.8
General Government	0.7	8.4	12.1	12.2
Maintenance and Construction of Local Streets[1]	4.3	14.0	8.8	7.1
Maintenance and Construction of Storm Sewers[1]	11.8	30.0	5.5	0.9
Park Maintenance	0.2	3.1	4.5	4.5
Debt Service	0	0	0	0
Total Expenditures[2]	$ 17.6	78.0	$ 56.6	$ 50.5
Baseline	$ 374.0	$ 387.3	$ 419.9	$ 548.8
Total Expenditures as a Percent of Baseline	5%	20%	13%	9%

Ashtabula Township	1979	1981	1986	1990
Law Enforcement	$ 0	$ 0	$ 0	$ 0
Fire Protection	0	7.6	21.1	25.4
General Government	0	9.9	27.1	32.6
Maintenance and Construction of Local Streets[1]	0	7.5	11.9	7.9
Maintenance and Construction of Storm Sewers[1]	0	18.3	6.6	0.5
Park Maintenance	0	1.0	2.6	3.2
Debt Service	0	0	5.2	4.8
Total Expenditures[2]	$ 0	$ 44.3	$ 74.5	74.4
Baseline	$ 963.2	$ 978.0	$1,014.8	$1,044.3
Total Expenditures as a Percent of Baseline	0%	5%	7%	7%

Ashtabula City	1979	1981	1986	1990
Law Enforcement	$ 0	$ 10.0	$ 15.0	$ 15.0
Fire Protection	0	8.6	11.9	11.9
General Government	0	13.1	18.2	18.3
Maintenance of Local Streets[1]	0	0	0	0
Maintenance of Storm Sewers[1]	0	0	0	0
Park Maintenance	0	1.8	2.5	2.4
Debt Service	0	5.2	4.7	4.3
Total Expenditures[2]	$ 0	$ 38.7	$ 52.3	$ 51.9
Baseline	$3,758.0	$3,704.0	$3,587.0	$3,445.0
Total Expenditures as a Percent of Baseline	0%	1%	1%	2%

Table 4-128 (Continued)

Saybrook Township	1979	1981	1986	1990
Law Enforcement	$ 0	$ 0	$ 0	$ 0
Fire Protection	0.2	5.2	4.3	3.0
General Government	0.2	6.1	5.1	3.5
Maintenance and Construction of Local Streets[1]	1.1	8.1	3.8	2.4
Maintenance and Construction of Storm Sewers[1]	2.9	19.2	0.1	0.1
Park Maintenance	0	0.9	0.7	0.5
Debt Service	0	0	0	0
Total Expenditures[2]	$ 4.4	$ 39.5	$ 14.0	$ 9.5
Baseline	$ 468.0	486.7	535.2	$ 574.4
Total Expenditures as a Percent of Baseline	1%	8%	3%	2%
Girard Area				
Law Enforcement	$ 0	$ 15.0	$ 15.0	$ 15.0
Fire Protection	0	0.5	1.1	1.3
General Government	0.1	3.8	8.1	9.4
Maintenance and Construction of Local Streets[1]	0.6	5.8	4.5	5.5
Maintenance and Construction of Storm Sewers[1]	2.1	17.6	0.3	0.4
Park Maintenance	0	0.9	1.9	2.0
Debt Service	0	0	0	0
Total Expenditures[2]	$ 2.8	$ 43.6	$ 30.9	$ 33.6
Baseline	$ 630.2	$ 635.1	$ 703.5	$ 761.9
Total Expenditures as a Percent of Baseline	*	7%	4%	4%
Fairview				
Law Enforcement	$ 0	$ 0	$ 0	$ 0
Fire Protection	0	0.1	0.1	0.1
General Government	0.4	5.3	5.7	4.4
Maintenance and Construction of Local Streets[1]	3.2	9.7	4.4	3.5
Maintenance and Construction of Storm Sewers[1]	12.7	28.0	2.7	0.4
Park Maintenance	0.1	1.2	1.3	1.0
Debt Service	0	0	0	0
Total Expenditures[2]	$ 16.4	$ 44.3	$ 14.2	$ 9.4
Baseline	$ 331.0	$ 339.3	$ 371.5	$ 398.6
Total Expenditures as a Percent of Baseline	5%	13%	4%	2%

Table 4-128 (Continued)

Millcreek Township	1979	1981	1986	1990
Law Enforcement	$ 1.0	$ 30.0	$ 10.0	$ 15.0
Fire Protection	0	0.5	0.3	0.2
General Government	0.5	9.2	6.7	4.4
Maintenance and Construction of Local Streets	3.1	5.8	2.4	1.8
Maintenance and Construction of Storm Sewers	13.9	14.0	0.8	0
Park Maintenance	0.2	4.9	3.5	2.4
Debt Service	0	0	0	0
Total Expenditures(2)	$ 18.7	$ 64.4	$ 23.7	$ 23.8
Baseline	$2,831.6	$2,886.8	$3,014.4	$3,162.4
Total Expenditures as a Percent of Baseline	1%	2%	1%	1%

(1) Includes construction costs which are assumed to be small enough to finance out of current revenues rather than from issuance of debt.

(2) Excludes expenditures for maintenance of sewer and water facilities. These expenditures are assumed to be finance out of user charges rather than tax revenues.

*Less than 0.5%.
Source: State and Local Tax Structure baseline; SIMPACT IV Model.

Table 4-129

Impact on Operating Expenditure Requirements of School Districts in the Coastal Communities -- 1979-1990 (Thousands of 1975 Dollars)

	1979	1981	1986	1990
Buckeye School District				
Operating Expenditures	$ 26	$ 337	$ 515	$ 600
Debt Service	0	0	0	0
Total Expenditures	$ 26	$ 337	$ 515	$ 600
Baseline	$ 4,062	$ 3,748	$3,356	$3,273
Total Expenditures as a Percent of Baseline	1%	9%	15%	18%
Ashtabula Area City School District				
Operating Expenditures	$ 6	$ 245	$ 434	$ 474
Debt Service	0	0	0	0
Total Expenditures	$ 6	$ 245	$ 434	$ 474
Baseline	$ 7,711	$ 6,965	$6,315	$6,154
Total Expenditures as a Percent of Baseline	*	4%	7%	8%
Girard School District				
Operating Expenditures	$ 6	$ 129	$ 296	$ 346
Debt Service	0	0	0	0
Total Expenditures	$ 6	$ 129	$ 296	$ 346
Baseline	$ 2,752	$ 2,685	$2,648	$2,721
Total Expenditures as a Percent of Baseline	*	5%	11%	13%
Fairview School District				
Operating Expenditures	$ 20	$ 206	$ 217	$ 174
Debt Service	0	0	0	0
Total Expenditures	$ 20	$ 206	$ 217	$ 174
Baseline	$ 3,365	$ 3,315	$3,151	$3,239
Total Expenditures as a Percent of Baseline	1%	6%	7%	5%
Millcreek School District				
Operating Expenditures	$ 16	$ 170	$ 133	$ 129
Debt Service	0	0	0	0
Total Expenditures	$ 16	$ 170	$ 133	$ 129
Baseline	$11,131	$10,626	$9,692	$8,126
Total Expenditures as a Percent of Baseline	*	2%	1%	2%

*Less than 0.5%

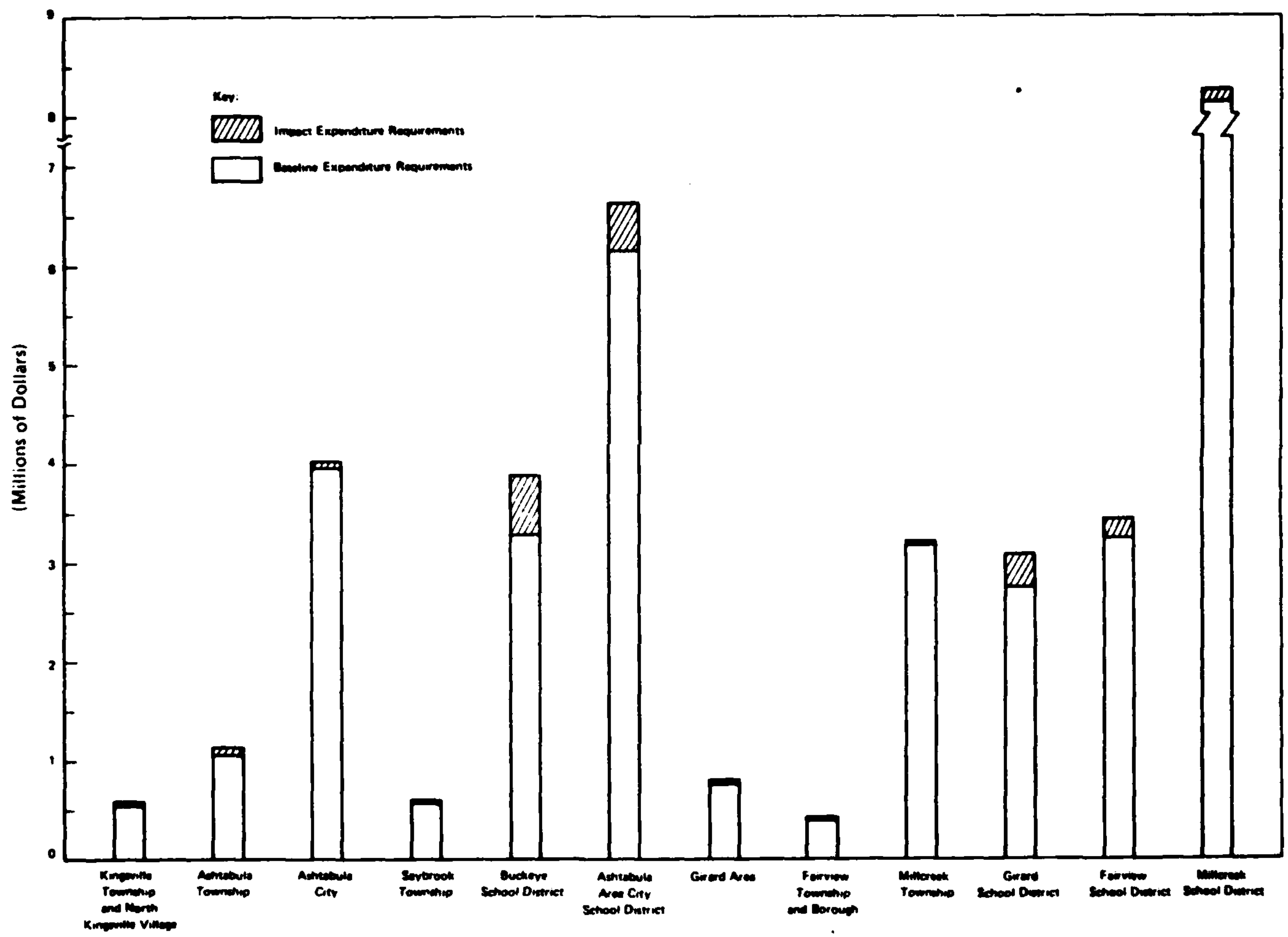
Source: Education Services baseline; SEIMPACT IV Model.

Table 4-130

Impact on Expenditure Requirements in the Coastal Communities -- 1979-1990
(Thousands of 1975 Dollars)

Ohio	1979	1981	1986	1990
Local Governments				
Kingsville Township and North Kingsville Village	$ 18 (5%)[1]	$ 78 (20%)	$ 57 (13%)	$ 51 (9%)
Ashtabula Township	0	44 (5%)	75 (7%)	74 (7%)
Ashtabula City	0	39 (1%)	52 (1%)	52 (2%)
Saybrook Township	4 (1%)	40 (8%)	14 (3%)	10 (2%)
School Districts				
Buckeye School District	26 (1%)	337 (9%)	515 (15%)	600 (18%)
Ashtabula Area City School District	6*	245 (4%)	434 (7%)	474 (8%)
Pennsylvania				
Local Governments				
Girard Area	3*	44 (7%)	31 (4%)	34 (4%)
Fairview Borough and Township	16 (5%)	44 (13%)	14 (4%)	9 (2%)
Millcreek Township	19 (1%)	64 (2%)	24 (1%)	24 (1%)
School Districts				
Girard School District	6*	129 (5%)	296 (11%)	346 (13%)
Fairview School District	20 (1%)	206 (6%)	217 (7%)	174 (5%)
Millcreek School District	16*	170 (2%)	133 (1%)	129 (2%)

[1] Number in parentheses indicate percent of baseline.
*Less than 0.5%.
Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.



Source: Table 4-130

FIGURE 4–28 IMPACT ON EXPENDITURE REQUIREMENTS IN THE PRINCIPAL STUDY AREA – 1990

highest levels of local Government expenditures would occur in Ashtabula Township. In 1986 and 1990 the estimated additional expenditures of nearly $75,000 and $74,000 respectively, represent a seven percent increase over projected baseline expenditure requirements. Kingsville Township and North Kingsville Village are expected to have the largest expenditure requirements relative to projected baseline amounts (20 percent in 1981) because in 1981 they would receive their largest influx of employees to work on the construction of the Lakefront facility. Millcreek Township would have its highest expenditure ($64,000) requirements during 1981, the year of peak plant construction. Millcreek already has large baseline expenditures and so the overall plant related impact would be relatively small (one percent - two percent). The Buckeye Local School District would have the highest estimated expenditure requirements among the school districts in the Ohio or Pennsylvania Principal Study Area, for example in 1990, estimated expenditures would be $600,000 or an increase of 18 percent over the projected baseline expenditures. Expenditure estimates for fire protection in the Pennsylvania Study Area have been adjusted to exclude expenditures that would be financed from carnival or other similar revenues. No law enforcement expenditures are indicated for some municipalities in the Principal Study Area because this service is expected to be provided either by the county (Ohio) or by the State Police (Pennsylvania).

Regional Study Area

4.289
Expenditure requirements for Ashtabula County would exceed an estimated $300,000 in 1990, an increase of nearly seven percent over projected baseline amounts. Although expenditure estimates would be higher in Erie County ($486,000) the increase over baseline levels would be only three percent. In both counties, general Government would be the largest expenditure category (refer to Table 4-131). No law enforcement costs are indicated for Erie County because the Erie County Sheriff is primarily an officer of the court. The Sheriff's office expenditures are included under general Government. In Pennsylvania the State Police provide law enforcement services to municipalities that do not have their own police departments.

Impact on Assessed Property Valuation

4.290
Local property tax revenues resulting from plant-related development are estimated on the basis of the assessed valuation of taxable property, which for the purpose of this statement is referred to as the property tax base. The impact on local property tax base involves two separate considerations: the addition of the assessed valuation of the proposed Lakefront facility to the tax base, and the addition to

Table 4-131

Impact on Operating Expenditures in the Regional Study Area -- 1979-1990
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Ashtabula County				
Law Enforcement (sheriff)	$ 0	$ 55.0	$ 65.0	$ 75.0
Social Services	0.3	7.8	16.5	19.1
General Government	3.3	85.7	182.1	211.2
Total Expenditures	3.6	$ 148.5	$ 263.6	$ 305.3
Baseline	$ 4,140.0	$ 4,182.0	$ 4,294.0	$ 4,373.0
Total Expenditures as a Percent of Baseline	*	4%	6%	7%
Erie County				
Social Services	$ 0.9	$ 11.6	$ 21.3	$ 24.9
General Government	16.0	298.7	443.0	461.6
Total Expenditures	16.9	$ 310.3	$ 464.3	$ 486.5
Baseline	$13,482.3	$13,679.1	$14,143.8	$14,526.4
Total Expenditures as a Percent of Baseline	1%	2%	3%	3%

*Less than 0.5%.
Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

the tax base of the assessed valuation of property associated with new commercial and residential development (secondary development-related impact). Plant induced impact refers to the addition to the tax base of the proposed Lakefront facility land and buildings, and in Ohio, machinery, equipment, and inventories. The proposed facility would be located within six separate taxing jurisdictions. Those in Ohio include Conneaut City, Conneaut Area City School District, and Ashtabula County, while in Pennsylvania they are: Springfield Township, Northwestern School District and Erie County.

4.291
The secondary development-related impact on assessed valuations has several components which affect to varying degrees the tax bases of each taxing jurisdiction in the coastal communities. These valuations have been estimated for each of the coastal communities using the applicant's SIMPACT IV Model. The residential component would reflect the valuation of the housing that is built to accommodate new residents moving into each community. Assessed valuation of residential property is derived by applying assessment ratios (35 percent in Ohio and 20 percent in Pennsylvania) to the estimated market value associated with each of the housing preference types assumed in the housing analysis. Consequently, the magnitude of the increase in residential assessed valuations in each community would reflect assumptions about the community location and housing type preferences of the residents moving into the area. The impact on commercial property valuation refers to the estimated assessed valuation of new or expanded commercial buildings -- primarily wholesale or retail trade and service establishments -- that are constructed in each community. Commercial facility construction requirements are directly related to the induced economic impact of the proposed facility (i.e., the economic activity resulting from increases in consumer spending). The assessed valuation of commercial property is derived by applying an assessment ratio to the estimated market value of newly constructed commercial buildings. Impact on the industrial property valuation refers to the assessed valuation of new or expanded industrial buildings that are constructed to meet the supplier needs associated with the proposed facility. Industrial facility construction requirements would result primarily from the indirect economic activity and the assessed valuation of these properties is estimated in the same manner as for commercial property.

4.292
In Ohio, the secondary development-related impact would include the valuation of the tangible personal property (machinery, equipment, and inventories) that would be associated with the construction of new or expanded commercial and industrial facilities. The impact on the assessed valuation of tangible personal property is estimated on the basis of historical relationships between the valuation of this

property and the valuation of commercial and industrial real estate. Secondary development-related impacts are disaggregated to show the impacts related to the construction of the proposed Lakefront facility and those related to its operations. In order to indicate the relative significance of the assessed valuation increases, they are compared to projected baseline assessed valuation estimates. Due to differences in assessment ratios, the magnitude of assessed valuations in Ohio taxing jurisdictions should not be compared with those in the Pennsylvania jurisdictions. Comparisons can be made among jurisdictions within each State since assessing for all jurisdictions is done by the county and all study area jurisdictions in each State are in the same county. For the taxing jurisdictions which would contain Lakefront facility property, the assessed valuation of this property is shown for the year the tax would be paid. For the Pennsylvania jurisdictions, the tax would be paid in the same year the property is assessed. In Ohio, the machinery and equipment is taxed in the same year as it is assessed. Real estate (land and buildings), however, is taxed in the year following the assessment year. Secondary development-related assessed valuation for the Ohio jurisdictions is shown for both the assessment years and the tax payment years.

Local Study Area

4.293

Secondary Development-Related Impact. The municipalities and school districts that comprise the Local Study Area are expected to receive the largest number of new residents as a result of the construction and operation of the proposed Lakefront plant. In Conneaut City and the Conneaut School District the tax base is estimated to increase by almost $23 million by 1990 as a result of plant-related secondary development, an increase of 30 percent for the city and nearly 28 percent for the school district (refer to Table 4-132). The increase would be relatively small during the initial construction period (1979-1981) but become more significant after the first step of the plant is completed and in operation (1982). Conneaut would also experience the largest increase in commercial and industrial valuation of any of the coastal communities because most of the indirect and induced commercial activity in the coastal communities would occur in Conneaut (refer to Figure 4-29 and Table 4-132). Increases in the tax base as a result of the plant induced secondary development would be smaller for Springfield Township, East Springfield Borough, and the Northwestern School District, but more significant in relation to the projected baseline. By 1990, the assessed valuation would increase by an estimated $6.4 million, which is nearly a 100 percent increase over the projected baseline amount for Springfield Township and Borough, and a 41 percent increase over projected baseline levels for the Northwestern School District. The

Table 4-132

Impact on Secondary Development-Related Assessed Property Valuation[1] in Conneaut City and Conneaut Area City School District[2] -- 1979-1990
(Thousands of 1975 Dollars)

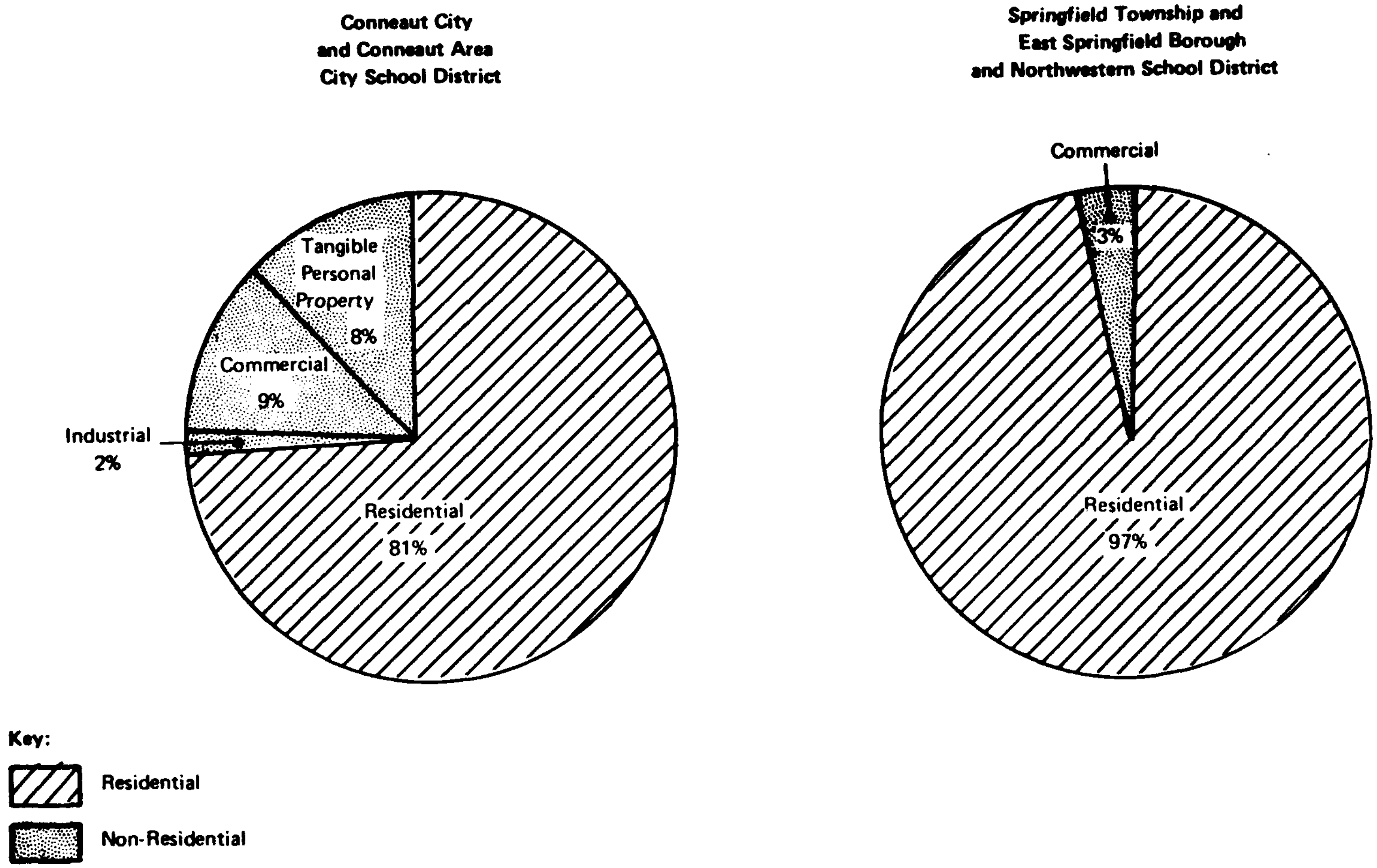
	1979	1981	1986	1990
Construction				
Residential	$ 82	$ 1,197	$ 561	$ 0
Commercial	179	866	617	0
Industrial	0	0	0	0
Tangible Personal Property	47	205	137	0
Total	$ 308	$ 2,268	$ 1,315	$ 0
Operations				
Residential	$ 0	$ 1,918	$12,973	$18,310
Commerical	0	294	1,368	2,097
Industrial	0	0	198	349
Tangible Personal Property	0	70	920	1,897
Total	$ 0	$ 2,282	$15,459	$22,653
Total				
Residential	$ 82	$ 3,115	$13,534	$18,310
Commercial	179	1,160	1,985	2,097
Industrial	0	0	198	349
Tangible Personal Property	47	275	1,057	1,897
Total	$ 308	$ 4,550	$16,774	$22,653
Baseline (Conneaut City)	$70,479	$71,330	$72,957	$74,286
Impact as a Percent of Baseline	*	6%	23%	30%
Baseline (Conneaut School District)	$75,882	$76,798	$78,550	$79,980
Impact as a Percent of Baseline	*	6%	21%	28%

(1) Secondary development related excludes assessed valuation of proposed Lakefront facility. Valuations are based on the year the property would be assessed.

(2) For estimation purposes, the SIMPACT IV Model assumes that all development in the Conneaut Area City District would occur within Conneaut City. Thus, the assessed valuation impact will be the same for the city and the school district. Baseline amounts will differ, however.

*Less than 0.5%

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model



Source: Tables 4-132 and 133

FIGURE 4–29 SECONDARY DEVELOPMENT-RELATED ASSESSED VALUATION BY TYPE IN THE LOCAL STUDY AREA – 1990

impact during the construction period would be small. Unlike Conneaut, the Springfield tax base is not expected to increase significantly as a result of secondary commercial and industrial activity (refer to Table 4-133).

Facility-Related Impact

4.294
To illustrate the relative magnitude of the facility-related impacts in the Local Study Area, the assessed valuation of the proposed facility to the baseline assessed valuation for each of the taxing jurisdictions in which the facility would be located are compared and presented in Table 4-134. For Conneaut City and the Conneaut School District, the estimated assessed valuation of the proposed Lakefront facility in 1990 ($174.6 million) is more than double the projected baseline assessed valuation. In Pennsylvania, the estimated increases would be even more significant. The facility valuation ($25.0 million) in 1990 would be nearly four times the projected baseline tax base of Springfield Township and more than one and one half times the tax base of the Northwestern School District (refer to Figure 4-30 and 4-31). Significant increases in assessed valuation in both States begin in 1982 when the plant is expected to be in full Step I operation. The combined impacts (direct and secondary) for each of the Local Study Area taxing jurisdictions in which the proposed Lakefront facility would be located are shown in Table 4-135 and Table 4-136.

Principal Study Area

4.295
The effect of impact-related development on the assessed valuation, by type, for taxing jurisdictions in the coastal communities of the Principal Study Area is shown in Tables 4-121 through 4-129. These impacts are all secondary development-related since the Lakefront facility would be in the Local Study Area only. These tables are summarzied in Table 4-130 allowing for easy comparison of the assessed valuation impacts in each taxing jurisdiction. Among the Ohio municipalities, Ashtabula Township would experience the largest increase in the size of its tax base -- $6.8 million in 1990, six percent over baseline levels. The tax base of Kingsville Township and North Kingsville Village would increase by an estimated 21 percent in 1986, which would be the largest increase over baseline levels among the coastal communities of the Principal Study Area. Of the two school districts in the area the Buckeye Local School District is expected to have the largest estimated increase in assessed valuation, $8.3 million in 1990, or an increase of six percent over projected baseline levels. In the Pennsylvania Principal Study Area, the Girard area municipalities and the Girard School

Table 4-133

Impact on Secondary Development-Related Assessed Property Valuation in Springfield Township and Borough[1] and Northwestern School District[2] -- 1979-1990[1]
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Construction				
Residential	$ 0	$ 330	$ 149	$ 0
Commercial	17	85	60	0
Industrial	0	0	0	0
Total	$ 17	$ 415	$ 209	$ 0
Operations				
Residential	$ 0	$ 719	$ 4,902	$ 6,215
Commercial	0	29	120	177
Industrial	0	0	0	0
Total	$ 0	$ 748	$ 5,022	$ 6,392
Total				
Residential	$ 0	$ 1,049	$ 5,051	$ 6,215
Commercial	17	114	180	177
Industrial	0	0	0	0
Total	$ 17	$ 1,163	$ 5,231	$ 6,392
Baseline (Springfield Township and Boro.)	$ 5,395	$ 5,561	$ 6,066	$ 6,419
Impact as a Percent of Baseline	*	21%	86%	100%
Baseline (Northwestern School District)	$13,424	$13,759	$14,813	$15,660
Impact as a Percent of Baseline	*	8%	35%	41%

(1) Secondary development-related excludes assessed valuation of proposed Lakefront facility.

(2) For estimation purposes, the SIMPACT IV Model assumes that all development in the Northwestern School District would occur in Springfield Township and East Springfield Borough and that only insignificant amounts will occur in the other municipalities in the District. Baseline estimates will differ, however.

*Less than 0.5%.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-134

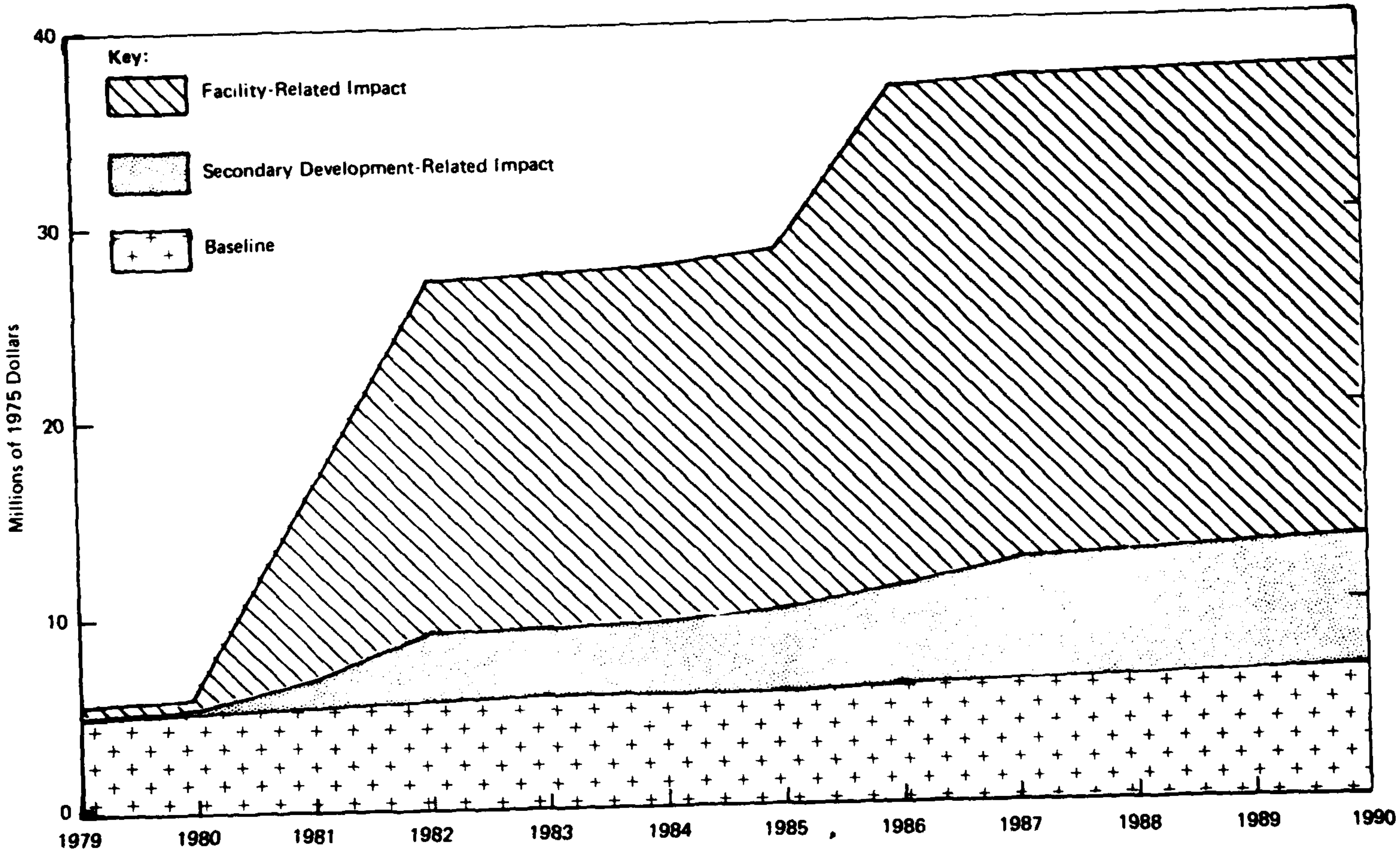
Assessed Property Valuation of the Proposed Lakefront Facility -- 1979-1990(1) (Millions of 1975 Dollars)

	1979	1981	1986	1990
Conneaut City				
Facility Valuation	$ 0.5	$ 0.5	$107.3	$174.6
Baseline	70.5	71.3	73.0	74.3
Facility Valuation as a Percent of Baseline	1%	1%	147%	235%
Conneaut Area City School District				
Facility Valuation	$ 0.5	$ 0.5	$107.3	$174.6
Baseline	75.9	76.8	78.6	80.0
Facility Valuation as a Percent of Baseline	1%	1%	137%	218%
Ashtabula County				
Facility Valuation	$ 0.5	$ 0.5	$107.3	$174.6
Baseline	573.2	578.0	594.0	605.1
Facility Valuation as a Percent of Baseline	*	*	18%	29%
Springfield Township and East Springfield Borough				
Facility Valuation	$ 0.2	$ 9.6	$ 25.0	$ 25.0
Baseline	5.4	5.6	6.1	6.4
Facility Valuation as a Percent of Baseline	4%	171%	410%	391%
Northwestern School District				
Facility Valuation	$ 0.2	$ 9.6	$ 25.0	$ 25.0
Baseline	13.4	13.8	14.8	15.7
Facility Valuation as a Percent of Baseline	1%	70%	169%	159%
Erie County				
Facility Valuation	$ 0.2	$ 9.6	$ 25.0	$ 25.0
Baseline	589.5	598.1	618.4	635.1
Facility Valuation as a Percent of Baseline	*	2%	4%	4%

(1) Valuations are based on the year the tax would be paid.

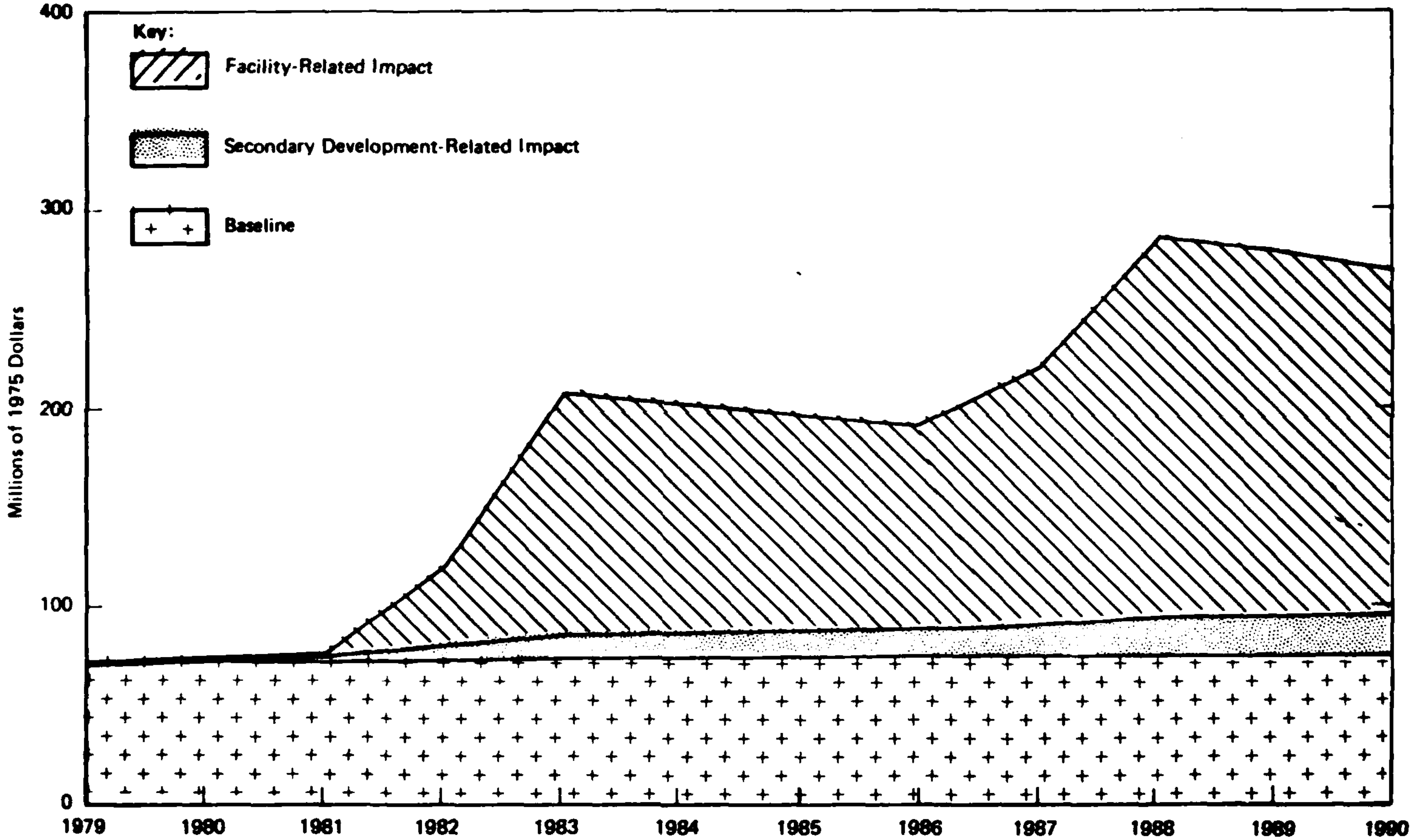
*Less than 0.5%.

Source: U.S. Steel Corporation and Arthur D. Little, Inc. estimates.



Source: Table 4-136

FIGURE 4–30 PLANT-RELATED IMPACT ON ASSESSED VALUATION IN SPRINGFIELD TOWNSHIP AND EAST SPRINGFIELD BOROUGH



Source: Table 4-135

FIGURE 4—31 PLANT-RELATED IMPACT ON ASSESSED VALUATION IN CONNEAUT CITY

Table 4-135

Impact on Assessed Property Valuation in Conneaut City and Conneaut Area City School District -- 1979-1990 (Thousands of 1975 Dollars)

	1979	1981	1986	1990
Facility-Related Assessed Valuation(1)	$ 500	$ 500	$107,300	$174,600
Secondary Development-Related Assessed Valuation	47	1,897	13,938	22,396
Total Impact on Assessed Valuation(2)	$ 547	$ 2,397	$121,238	$196,996
Baseline (Conneaut City)	$70,479	$71,330	$ 72,957	$ 74,256
Impact as a Percent of Baseline	1%	3%	166%	265%
Baseline (Conneaut Area City School District)	$75,882	$76,798	$ 78,550	$ 79,980
Impact as a Percent of Baseline	1%	3%	154%	246%

(1) Includes land, buildings, machinery and equipment and inventories.

(2) Secondary development-related and facility-related valuations are estimated for the year in which the tax would be paid.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model; United States Steel Corporation; Arthur D. Little, Inc. estimates.

Table 4-136

Impact on Assessed Property Valuation in Springfield Township and East Springfield Borough -- 1979-1990
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Facility-Related Assessed Valuation[1]	$ 200	$ 9,600	$25,000	$25,000
Secondary Development-Related Assessed Valuation	17	1,163	$ 5,231	$ 6,392
Total Impact on Assessed Valuation	$ 217	$10,763	$30,231	$31,392
Baseline (Springfield Township and East Springfield Borough)	$ 5,395	$ 5,561	$ 6,066	$ 6,419
Impact as a Percent of Baseline	4%	194%	498%	489%
Baseline (Northwestern School District)	$13,424	$13,759	$14,813	$15,660
Impact as a Percent Baseline	2%	10%	204%	200%

(1) Includes land and buildings.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model; United States Steel Corporation; Arthur D. Little, Inc. estimates.

District would have the largest estimated relative and absolute increases in assessed valuations -- $2.8 million in 1990, or about 12 percent over projected baseline amounts.

4.296
The largest plant-related impact on the residential valuations in the Ohio Coastal Communities is expected to occur in Ashtabula Township -- an estimated $6.7 million by 1990 (refer to Table 4-122). For commercial and tangible personal property the largest increase in valuation would occur in Ashtabula City with valuation increasing by $541,000 and $119,000, respectively, by 1990 (refer to Table 4-123). The other municipalities in the Ohio Coastal Communities would have small additional commercial valuations, but no increase in industrial valuations. Increases in industrial valuations are not expected in the Ohio Principal Study Area. Higher residential assessments during the construction period would occur in Saybrook Township, amounting to nearly $2.2 million in 1981 (refer to Table 4-140).

4.297
Among the coastal communities in the Pennsylvania Principal Study Area, the greatest impact on residential assessments would occur in the Girard area with an addition of $2.7 million in 1990 (refer to Table 4-143). The impact on the commercial tax base in the Pennsylvania Coastal Communities would be small, with the highest amount ($61,000) occurring in Girard (refer to Table 4-143). No increase is expected in the assessed valuation of industrial property in any of the Pennsylvania Coastal Communities. The largest plant-related impact on residential assessments as a result of the construction of the proposed facility would occur in Millcreek Township, with an additional $1.1 million in 1981. In some communities the greatest effect on assessed valuation would occur early in the projection period, with subsequent declines in later years. (These communities reach their peak population during the construction period). However, it is likely that the secondary plant-related assessed valuation would not decline as rapidly as does population. The residential and commercial facilities built to meet the needs of construction employees would still remain on the tax rolls, even if they are not needed to meet the needs of the smaller number of operations employees. Consequently, for these communities the assessed valuation impact could be somewhat higher in the non-construction years than is indicated herein.

Regional Study Area

4.298
Plant-related secondary development effects on assessed property valuation in Ashtabula County would consist mainly of residential property amounting to more than $41 million in 1990. This amount is

Table 4-137

Impact on Assessed Property Valuation in Kingsville Township and North Kingsville Village -- 1979-1990[1]
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Construction				
Residential	$ 382	$ 1,769	$ 856	$ 0
Commercial	9	45	32	0
Industrial	0	0	0	0
Tangible Personal Property	2	11	7	0
Total	$ 393	$ 1,825	$ 895	$ 0
Operations				
Residential	$ 0	$ 1,703	$ 4,208	$ 5,228
Commercial	0	15	62	90
Industrial	0	0	0	0
Tangible Personal Property	0	3	14	20
Total	$ 0	$ 1,721	$ 4,284	$ 5,338
Total				
Residential	$ 382	$ 3,472	$ 5,064	$ 5,228
Commercial	9	60	94	90
Industrial	0	0	0	0
Tangible Personal Property	2	14	21	20
Total	$ 393	$ 3,546	$ 5,179	$ 5,338
Baseline	$21,989	$22,774	$24,732	$26,309
Impact as a Percent of Baseline	2%	16%	21%	20%

(1) Valuations are based on the year the property would be assessed.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-138

Impact on Assessed Property Valuation in Ashtabula Township -- 1979-1990(1) (Thousands of 1975 Dollars)

	1979	1981	1986	1990
Construction				
Residential	$ 0	$ 1,024	$ 511	$ 0
Commercial	8	39	28	0
Industrial	0	0	0	0
Tangible Personal Property	2	9	6	0
Total	$ 10	$ 1,072	$ 345	$ 0
Operations				
Residential	$ 0	$ 1,188	$ 5,136	$ 6,720
Commercial	0	14	55	81
Industrial	0	0	0	0
Tangible Personal Property	0	3	12	18
Total	$ 0	$ 1,205	$ 5,203	$ 6,819
Total				
Residential	$ 0	$ 2,212	$ 5,647	$ 6,720
Commercial	8	53	83	81
Industrial	0	0	0	0
Tangible Personal Property	2	12	18	18
Total	$ 10	$ 2,277	$ 5,748	$ 6,819
Baseline	$106,356	$106,655	$107,248	$107,989
Impact as a Percent of Baseline	*	2%	5%	6%

(1) Valuations are based on the year the property would be assessed.
*Less than 0.5%.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-139

Impact on Assessed Property Valuation in Ashtabula City -- 1979-1990[1]
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Construction				
Residential	$ 0	$ 457	$ 194	$ 0
Commercial	56	246	179	0
Industrial	0	0	0	0
Tangible Personal Property	15	58	40	0
Total	$ 71	$ 761	$ 413	$ 0
Operations				
Residential	$ 0	$ 126	$ 1,063	$ 1,579
Commercial	0	89	363	541
Industrial	0	0	0	0
Tangible Personal Property	0	21	80	119
Total	$ 0	$ 236	$ 1,506	$ 2,239
Total				
Residential	$ 0	$ 583	$ 1,257	$ 1,579
Commercial	56	335	542	541
Industrial	0	0	0	0
Tangible Personal Property	15	79	120	119
Total	$ 71	$ 997	$ 1,919	$ 2,239
Baseline	$87,832	$87,832	$87,832	$87,832
Impact as a Percent of Baseline	*	1%	2%	3%

(1) Valuations are based on the year the property would be assessed.
*Less than 0.5%

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-140

Impact on Assessed Property Valuation in Saybrook Township -- 1979-1990[1]
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Construction				
Residential	$ 96	$ 1,142	$ 559	$ 0
Commercial	5	29	20	0
Industrial	0	0	0	0
Tangible Personal Property	1	7	4	0
Total	$ 102	$ 1,178	$ 583	$ 0
Operations				
Residential	$ 0	$ 1,046	$ 1,454	$ 1,448
Commercial	0	9	37	54
Industrial	0	0	0	0
Tangible Personal Property	0	2	8	12
Total	$ 0	$ 1,057	$ 1,499	$ 1,514
Total				
Residential	$ 96	$ 2,188	$ 2,013	$ 1,448
Commercial	5	38	57	54
Industrial	0	0	0	0
Tangible Personal Property	1	9	12	12
Total	$ 102	$ 2,235	$ 2,082	$ 1,514
Baseline	$68,057	$70,780	$77,821	$83,500
Impact as a Percent of Baseline	*	3%	3%	2%

(1) Valuations are based on the year the property would be assessed.
*Less than 0.5%

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-141

Impact on Assessed Property Valuation of the Buckeye Local School District -- 1979-1990(1)
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Construction				
Residential	$ 382	$ 2,257	$ 1,089	$ 0
Commercial	30	139	100	0
Industrial	0	0	0	0
Tangible Personal Property	8	33	22	0
Total	$ 420	$ 2,429	$ 1,211	$ 0
Operations				
Residential	$ 0	$ 2,136	$ 6,254	$ 7,966
Commercial	0	49	200	297
Industrial	0	0	0	0
Tangible Personal Property	0	12	44	65
Total	$ 0	$ 2,197	$ 6,498	$ 8,328
Total				
Residential	$ 382	$ 4,393	$ 7,343	$ 7,966
Commercial	30	188	300	297
Industrial	0	0	0	0
Tangible Personal Property	8	45	66	65
Total	$ 420	$ 4,626	$ 7,709	$ 8,328
Baseline	$130,968	$131,180	$131,699	$131,920
Impact as a Percent of Baseline	*	3%	6%	6%

(1) Valuations are based on the year the property would be assessed.
*Less than 0.5%

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-142

Impact on Assessed Property Valuation of the
Ashtabula Area City School District -- 1979-1990(1)
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Construction				
Residential	$ 96	$ 2,134	$ 1,032	$ 0
Commercial	48	220	159	0
Industrial	0	0	0	0
Tangible Personal Property	13	52	35	0
Total	$ 157	$ 2,406	$ 1,226	$ 0
Operations				
Residential	$ 0	$ 1,926	$ 5,607	$ 7,008
Commercial	0	78	317	472
Industrial	0	0	0	0
Tangible Personal Property	0	19	70	104
Total	$ 0	$ 2,023	$ 5,994	$ 7,584
Total				
Residential	$ 96	$ 4,060	$ 6,639	$ 7,008
Commercial	48	298	476	472
Industrial	0	0	0	0
Tangible Personal Property	13	71	105	104
Total	$ 157	$ 4,429	$ 7,220	$ 7,584
Baseline	$166,410	$ 166,704	$167,492	$168,017
Impact as a Percent of Baseline	*	3%	4%	5%

(1) Valuations are based on the year the property would be assessed.
*Less than 0.5%.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-143

Impact on Assessed Property Valuation in the Girard Area[1]
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Construction				
Residential	$ 50	$ 406	$ 167	$ 0
Commercial	6	28	20	0
Industrial	0	0	0	0
Total	$ 56	$ 434	$ 187	$ 0
Operations				
Residential	$ 0	$ 523	$ 2,011	$ 2,707
Commercial	0	10	41	61
Industrial	0	0	0	0
Total	$ 0	$ 533	$ 2,052	$ 2,768
Total				
Residential	$ 50	$ 929	$ 2,178	$ 2,707
Commercial	6	38	61	61
Industrial	0	0	0	0
Total	$ 56	$ 967	$ 2,239	$ 2,768
Baseline	$18,933	$20,557	$22,425	$23,935
Impact as a Percent of Baseline	*	5%	10%	12%

(1) Includes Girard Borough and Township and Platea and Lake City Boroughs.
*Less than 0.5%

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-144

Impact on Assessed Property Valuation in Fairview Township and Borough[1]
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Construction				
Residential	$ 163	$ 879	$ 452	$ 0
Commercial	5	22	16	0
Industrial	0	0	0	0
Total	$ 168	$ 901	$ 468	$ 0
Operations				
Residential	$ 0	$ 592	$ 1,265	$ 1,390
Commercial	0	8	31	46
Industrial	0	0	0	0
Total	$ 0	$ 600	$ 1,296	$ 1,436
Total				
Residential	$ 163	$ 1,471	$ 1,717	$ 1,390
Commercial	5	30	47	46
Industrial	0	0	0	0
Total	$ 168	$ 1,501	$ 1,764	$ 1,436
Baseline	$30,723	$32,264	$36,661	$39,329
Impact as a Percent of Baseline	1%	5%	5%	4%

(1) Valuation estimates are the same for Fairview School District.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; and SIMPACT IV Model.

Table 4-149

Impact on Assessed Property Valuation
in Millcreek Township[1]
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Construction				
Residential	$ 156	$ 1,127	$ 551	$ 0
Commercial	0	0	0	0
Industrial	0	0	0	0
Total	$ 156	$ 1,127	$ 551	$ 0
Operations				
Residential	$ 0	$ 237	$ 574	$ 1,088
Commercial	0	0	0	0
Industrial	0	0	0	0
Total	$ 0	$ 237	$ 574	$ 1,088
Total				
Residential	$ 156	$ 1,364	$ 1,125	$ 1,088
Commercial	0	0	0	0
Industrial	0	0	0	0
Total	$ 156	$ 1,364	$ 1,125	$ 1,088
Baseline	$120,577	$122,297	$125,982	$130,352
Impact as a Percent of Baseline	*	1%	1%	1%

[1] Valuation estimates are the same for Millcreek School District.
*Less than 0.5%.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-146

Summary of Impact on Assessed Property Valuation
in the Principal Study Area -- 1979-1990
(Millions of 1975 Dollars)

	1979	1981	1986	1990
Ohio				
Kingsville Township and N. Kingsville Village	\$ 0.4(1) (2%)	\$ 3.5 (16%)	\$ 5.2 (21%)	\$ 5.3 (20%)
Ashtabula Township	0.01 *	2.3 (2%)	5.7 (5%)	6.8 (6%)
Ashtabula City	0.1 *	1.0 (1%)	1.9 (2%)	2.2 (3%)
Saybrook Township	0.1 *	2.2 (3%)	2.1 (3%)	1.5 (2%)
Buckeye Local School District	0.4 *	4.6 (3%)	7.7 (6%)	8.3 (6%)
Ashtabula Area City School District	0.2 *	4.4 (3%)	7.2 (4%)	7.6 (5%)

Table 4-146 (Continued)

	1979	1981	1986	1990
Pennsylvania				
Girard Area	$ 0.1 *	$ 1.0 (5%)	$ 2.2 (10%)	$ 2.8 (12%)
Fairview Township and Borough	0.2 (1%)	1.5 (5%)	1.8 (5%)	1.4 (4%)
Millcreek Township	0.2 *	1.4 (1%)	1.1 (1%)	1.1 (1%)
Girard School District	0.01 *	1.0 (5%)	2.2 (10%)	2.8 (12%)
Fairview School District	0.2 (1%)	1.5 (5%)	1.8 (5%)	1.4 (4%)
Millcreek Scho l District	0.2 *	1.4 (1%)	1.1 (1%)	1.1 (1%)

(1) Numbers in parentheses indicate percent of baseline.

*Less than 0.5%.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

equal to nearly seven percent of the county's total projected baseline assessed valuation (refer to Table 4-147). In Erie County, the impact would be less significant -- $14 million in 1990, or about two percent of the projected baseline amount (refer to Table 4-148). The facility-related impact on assessed valuation would also constitute a substantial addition to the individual tax base of Ashtabula and Erie Counties, but because of their larger baseline valuations, it is of less relative signficance than to the local Governments and school districts. The valuation in Ashtabula County would increase by 29 percent in 1990 and in Erie County by four percent (refer to Table 4-134). As a result of the combined secondary development-related and facility-related impacts, assessed valuation would increase by an estimated 36 percent in Ashtabula County in 1990, and an estimated six percent in Erie County during the same year (refer to Tables 4-149 and 4-150).

Impact on Local Government and School District Property Tax Rates

4.299
The approach used to estimate plant-related impact on property tax rates is presented below:

- Adding the baseline and impact expenditure requirements, which gives the total expenditure requirements,

- Subtracting from that amount the total revenues available from nonproperty tax sources (e.g., local income taxes) under baseline and impact conditions, and

- Dividing this amount (i.e., the revenue to be raised from the property tax) by the total assessed valuation (baseline plus impact) to estimate the new property tax rate.

4.300
The effects of plant-related development on property tax rates have been worked out separately for municipalities, school districts, and counties. The significance of the estimated tax rate changes is shown by a comparison of the taxes paid on a $40,000 home in each taxing jurisdiction under baseline and impact conditions. The estimated tax rates herein are not definitive forecasts or projections of future rates. Rather, they are order of magnitude estimates of a possible range of future effects, given the assumptions made in estimating revenues, expenditures and assessed valuations. Eventual tax rate effects will depend on local decisions and on political and economic consideration regarding the scope and quality of public expenditures and the distributions of the tax burden.

Table 4-147

Impact on Secondary Development-Related Assessed Property Valuation(1) in Ashtabula County -- 1979-1990
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Construction				
Residential	$ 750	$ 6,191	$ 2,924	$ 0
Commercial	258	1,225	876	0
Industrial	0	0	0	0
Tangible Personal Property	68	289	193	0
Total	$ 1,076	$ 7,705	$ 3,993	$ 0
Operations				
Residential	$ 0	$ 6,919	$ 27,701	$ 36,551
Commercial	0	421	1,884	2,865
Industrial	0	0	198	349
Tangible Personal Property	0	100	1,034	1,715
Total	$ 0	$ 7,440	$ 30,817	$ 41,480
Total				
Residential	$ 750	$ 13,110	$ 30,625	$ 36,551
Commercial	258	1,646	2,760	2,865
Industrial	0	0	198	349
Tangible Personal Property	68	389	1,227	1,715
Total	$ 1,076	$ 15,145	$ 34,810	$ 41,480
Baseline	$573,150	$577,958	$594,013	$605,059
Impact as a Percent of Baseline	*	3%	6%	7%

(1) Secondary development-related excludes assessed valuation of Lakefront facility. Valuations are based on the year the property would be assessed.

*Less than 0.5%.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-148

Impact on Secondary Development-Related Assessed Property Valuation in Erie County -- 1979-1990[1]
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Construction				
Residential	$ 634	$ 4,516	$ 2,120	$ 0
Commercial	28	136	96	0
Industrial	14	163	109	0
Total	$ 676	$ 4,813	$ 2,325	$ 0
Operations				
Residential	$ 0	$ 2,582	$ 10,000	$ 13,667
Commercial	0	47	192	285
Industrial	0	0	2	3
Total	$ 0	$ 2,629	$ 10,194	$ 13,955
Total				
Residential	$ 634	$ 7,096	$ 12,120	$ 13,667
Commercial	28	183	288	285
Industrial	14	163	111	3
Total	$ 676	$ 7,442	$ 12,519	$ 13,955
Baseline	$589,490	$598,090	$618,437	$635,148
Impact as a Percent of Baseline	*	1%	2%	2%

(1) Secondary development-related excludes the assessed valuation of the Lakefront facility.

*Less than 0.5%

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-149

Impact on Assessed Property Valuation in Ashtabula County -- 1979-1990[1]
(Thousands of 1974 Dollars)

	1979	1981	1986	1990
Secondary-Development-Related Assessed Valuation	$ 68	$ 6,875	$ 29,607	$ 41,276
Facility-Related Assessed Valuation	500	500	107,300	174,600
Total Impact on Assessed Valuation	$ 568	$ 7,375	$136,907	$215,876
Baseline	$573,150	$577,958	$594,013	$605,059
Total Impact as a Percent of Baseline	*	1%	23%	36%

(1) Valuations are estimated on the basis of the year the tax would be paid.

*Less than 0.5%

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model; United States Steel Corporation; Arthur D. Little, Inc. estimates.

Table 4-150

Impact on Assessed Property Valuation in Erie County -- 1979-1990
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Secondary Development-Related Assessed Valuation	$ 676	$ 7,442	$ 12,519	$ 13,955
Facility-Related Assessed Valuation	200	9,600	25,000	25,000
Total Impact on Assessed Valuation	$ 876	$ 17,042	$ 37,519	$ 38,955
Baseline	$589,490	$598,090	$618,937	$635,148
Total Impact as a Percent of Baseline	*	3%	6%	6%

*Less than 0.5%

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model; United States Steel Corporation; Arthur D. Little, Inc. estimates.

Local Governments

4.301
Conneaut City. Conneaut City could reduce its property tax rates substantially as a result of impact-related development. Under the current revenue structure the property tax rate could decline from the projected baseline rate of \$5.70 to less than \$1.00. Alternatively, the city could reduce its income tax rate from the current one percent level and still make significant reductions in the property tax rate. These possible rate reductions result from the addition of the assessed valuation of the lakefront facility to the city's tax base and the additional income tax revenues from the facility construction and operations employees. To illustrate these potential effects, two alternative cases are examined below, a maximum property tax rate reduction and an income tax rate reduction case. Both are presented to provide a range of possible alternatives that might be available to local officials.

4.302
Maximum Property Tax Rate Reduction (Case I). Conneaut tax rate would begin to decline in 1979 and 1980 as shown in Table 4-151. In 1980, the \$27 million construction payroll would generate income tax revenues of nearly \$268,000 (refer to Table 4-152). Although this represents a substantial increase in revenues, expenditure requirements would be minimal since only 300 plant-related new residents are expected to settle in Conneaut in 1980. The net result could be a possible decline in the 1980 tax from the baseline rate of \$5.70 per thousand of assessed valuation to \$3.00, a 47 percent decrease (refer to Table 4-151). During 1981, the year of peak construction activity and the beginning of operations, the tax rate would drop to \$0.80, an 86 percent reduction from the projected baseline rate. Construction payroll during this year would reach nearly \$40 million and generate over \$100,000 in Conneaut income tax revenues. The total income tax revenues in 1981 of over \$500,000 (including \$10,000 in income tax revenues from indirect and induced business establishments) would equal about 80 percent of the total income tax revenues (Conneaut's largest revenue source) received by Conneaut in 1975, and would equal more than three times the 1981 plant-related expenditure requirements.

4.303
In 1982, the tax rate is expected to increase because of the sharp decline in construction activity and the concomitant loss of construction-related income tax revenues. Construction-related income tax revenues would decline from nearly \$400,000 in 1981 to only \$39,000 in 1982 (refer to Table 4-152). The city would, however, receive income tax revenues from the payroll of plant operations employees (\$352,000), so that total income tax revenues would

Table 4-151

Impact on Property Tax Rates in Conneaut City
(Thousands of 1975 Dollars)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Baseline Expenditure Requirement	$ 1,571	$ 1,579	$ 1,587	$ 1,595	$ 1,604	$ 1,612	$ 1,620	$ 1,628	$ 1,635	$ 1,642	$ 1,650	$ 1,657
Impact Expenditure Requirement	4	80	166	364	272	282	302	401	486	459	461	477
(1) Total Expenditure Requirements	$ 1,575	$ 1,659	$ 1,753	$ 1,959	$ 1,876	$ 1,894	$ 1,922	$ 2,029	$ 2,121	$ 2,101	$ 2,111	$ 2,134
Baseline Nonproperty Tax Revenues	$ 1,166	$ 1,172	$ 1,178	$ 1,184	$ 1,191	$ 1,197	$ 1,203	$ 1,209	$ 1,214	$ 1,219	$ 1,225	$ 1,230
Impact Nonproperty Tax Revenues	66	274	315	416	417	443	640	778	670	667	669	671
(2) Total Nonproperty Tax Revenues	$ 1,232	$ 1,446	$ 1,493	$ 1,600	$ 1,608	$ 1,640	$ 1,843	$ 1,987	$ 1,884	$ 1,886	$ 1,894	$ 1,901
Facility-Related Assessed Valuation	$ 500	$ 500	$ 500	$ 45,800	$126,400	$117,700	$112,600	$107,300	$129,900	$193,000	$183,700	$174,000
Secondary Development Related Assessed Valuation	47	399	1,897	4,900	11,922	12,020	12,670	13,938	17,070	21,787	21,794	22,[illegible]
Baseline Assessed Valuation	70,479	71,009	71,330	71,[illegible]	72,477	72,302	72,629	72,9[illegible]	73,287	73,619	73,952	74,28[illegible]
(3) Total Assessed Valuation*	$ 71,026	$ 71,908	$ 73,727	$122,[illegible]	$210,799	$202,022	$197,699	$194,[illegible]	$220,257	$288,406	$279,446	$271,262
(4) Amount to be Raised by Property Tax**	$ 343	$ 213	$ 60	$ 359	$ 268	$ 254	$ 79	$ 42	$ 237	$ 215	$ 217	$ 233
(5) Impact Property Tax Rate***	$ 4.80	$ 3.00	$ .80	$ 2.90	$ 1.30	$ 1.30	$ .40	$ .20	$ 1.10	$ .70	$ .80	$ .90
Baseline Property Tax Rate	$ 5.70	$ 5.70	$ 5.70	$ 5.70	$ 5.70	$ 5.70	$ 5.70	$ 5.73	$ 5.70	$ 5.70	$ 5.70	$ 5.70
Tax Rate Increase (Decrease) as a Percent of Baseline Tax Rate	(16%)	(47%)	(86%)	(49%)	(77%)	(77%)	(93%)	(96%)	(81%)	(88%)	(86%)	(8[illegible])

*Valuations are estimated for the year in which the tax would be paid

**(4) = (1) - (2)

***(5) = (4) ÷ (3) Tax rates in dollars per thousand of assessed valuation

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model; United States Steel Corporation; Arthur D. Little, Inc. estimates.

Table 4-152

Impact on Local Income Tax Revenues[1] in Conneaut City -- 1979-1990
(Thousands of 1975 Dollars)

	Construction-Related	Operations-Related	Total
1979	$ 64	$ 0	$ 64
1980	268	0	268
1981	392	107	499
1982	39	352	392
1983	0	381	381
1984	22	383	405
1985	214	383	597
1986	287	440	727
1987	23	585	608
1988	0	603	603
1989	0	605	605
1990	0	606	606

(1) Paid by individuals only. Revenues from indirect and induced business activity would be small - less than 5% of these amounts.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model; United States Steel Corporation; Arthur D. Little, Inc. estimates.

decline by only about $100,000. During this same year, expenditure requirements resulting from impact-related development would be higher than in 1981, about $364,000, much of which results from improved road and storm sewer construction requirements.

4.304
In 1983 and 1984, the tax rate could decline again as more than $100 million in lakefront facility assessed valuation is added to the Conneaut tax base. This amount, which exceeds the projected baseline assessed valuation in those years, could cause the tax rate to drop to $1.30. In 1985 and 1986, the tax rate would decline even further reaching a projection period low of $0.20 in 1986, a 96 percent reduction from the baseline rate. These reductions reflect the additional income tax revenues from the workers involved in construction of Step II of the lakefront facility in Conneaut. In 1986, plant-related income tax revenues would reach their high point for the projection period ($727,000) of which $287,000 would be collected from Phase II construction workers and $440,000 from operations workers. This amount is greater than the total income tax revenues collected by the city in 1975 (refer to Table 4-152).

4.305
The rate would increase slightly in 1987 because income tax revenues decline commensurate with declining construction activity for Step II. After 1987 the rate would decline again as the assessed valuation of Step II facilities is added to the city's tax base. A slight increase in the tax rate will occur in 1989 and 1990 primarily due to the depreciation of lakefront facility machinery and equipment. The tax rates shown on Table 4-151 are minimums based on the estimated expenditure requirements and the assumption of no change in the local income tax rates. Under these conditions, U.S. Steel would pay a large share of the property tax in Conneaut beginning in 1983 as U.S. Steel property is added to the tax base. By 1990, property taxes paid by the applicant would account for about two thirds of the total property tax revenues of the city (refer to Table 4-153). The yearly fluctuation in property tax revenues reflect the changes in the tax rates as indicated on Table 4-151.

4.306
City revenues from all sources under baseline and plant-related conditions for selected years of the projection period are shown in Table 4-154. Income tax revenues from U.S. Steel-related development would account for about 30 percent of Conneaut's total revenues in 1981, 37 percent in 1986 and 30 percent in 1990. As a result of the lower property tax rates, taxpayers would receive reductions in their annual tax liability. From 1983 to 1990, after the assessed valuation of the lakefront facility is added to the Conneaut tax base, the tax reductions, using a home with a $40,000 market value as

Table 4-153

Impact on Property Tax Revenues in Conneaut City Under the Maximum Property Tax Rate Reduction Case -- 1979-1990 (Thousands of 1975 Dollars)

	1979	1981	1983	1986	1990
Property Tax Revenues from Baseline Property	$ 340	$ 57	$ 94	$ 15	$ 68
Property Tax Revenues from Secondary Development	0	2	16	3	20
Property Tax Revenues from Proposed Lakefront Facility	2	0	163	21	157
Total Property Tax Revenues	$ 342	$ 59	$ 273	$ 39	$ 245
Facility-Related as a Percent of Total Property Tax Revenues	1%	0	60%	54%	64%
Total Revenues	$1,575	$1,753	$1,876	$2,029	$2,134
Facility-Related as a Percent of Total Revenues		0	9%	1%	7%

*Less than 0.5%

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model; United States Steel Corporation; Arthur D. Little, Inc. estimates.

Table 4-154

Impact on Revenues by Source in Conneaut City Under the Maximum Property Tax Rate Reduction Case -- 1979-1990 (Thousands of 1975 Dollars)

	1979	1981	1986	1990
Baseline Nonproperty Tax Revenues	$1,166	$1,178	$1,208	$1,230
Total Property Tax Revenues (Impact and Baseline)	343	59	39	245
Impact-Related Nonproperty Tax Revenues	66	515	779	671
Income Tax	66	509	754	639
Motor Vehicle License Tax	0	3	12	15
Miscellaneous Revenues	0	3	13	17
Total Revenues(1)	$1,575	$1,752	$2,026	$2,146

(1)May differ slightly from total expenditures requirements because of tax rate rounding.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

an example, would range between $62 and $77 (refer to Table 4-155). However, if city expenditures are assumed to be greater than those estimated on Table 4-151, the tax rate reductions would not be as large. In general, any increase in expenditure requirements beyond those indicated on Table 4-151 would be financed from the property tax, with the applicant accounting for approximately the same proportion of the total amount as its property bears to the total tax base. Expenditures could be higher than the amounts shown on Table 4-151 due to sewerage and water supply system costs. Plant-related sewerage treatment and water supply system costs are assumed to be financed from user charges, so these expenditures are not included on Table 4-151. If the city chooses to finance a portion of these expenditures from property tax revenues, the property tax rate would be higher. For example, the annual principal and interest cost for expansion of the Conneaut water supply system would be $67,000. The city could finance these costs from the property tax revenues instead of from user charges, and still have a substantial reduction in the property tax rate.

4.307
Income Tax Rate Reduction Case (Case II). As an alternative to reducing the property tax, the city could choose to reduce or eliminate the income tax. If the income tax rate were reduced from the current one percent to 1/2 percent, after the proposed lakefront plant property has been added to the tax base, the property tax rate could still be reduced. Under these conditions the property tax rate in 1990 would be $3.30. This would reflect a 42 percent reduction from the projected baseline rate, but would be much higher than the $0.90 rate under the maximum tax rate reduction case (refer to Table 4-156 and Table 4-157). Under Case II, property taxes from baseline property plant-related secondary development, and from U.S. Steel would be greater than under Case I (refer to Table 4-157). The property taxes paid by U.S. Steel would constitute approximately the same percentage of total property tax revenues as under the first case (64 percent). However, the applicant's property taxes would constitute a greater share of the city's total operating revenues (refer to Table 4-158 and Figure 4-32). Under Case II, the property taxes paid by homeowners would also be greater than under Case I. For example, in 1990, the tax on a $40,000 home would be $46 instead of $13. Nevertheless, some taxpayers might fare better under this case. For example, if the owner of a $40,000 home receives an annual salary of $15,000, his income tax under Case I would be $75 instead of $150 as under Case II. The taxpayer would pay $33 more in his property tax but would save $75 on his local income tax.

4.308
This example is only one simplified and limited aspect of the potential future tax policy decisions which could be made by the officials

Table 4-155

Impact on Property Taxes in Conneaut City on a $40,000 Home (1)
Under the Maximum Property Tax Rate Reduction Case -- 1979-1990

	Baseline	Impact	Property Tax Reduction
1979	$ 80	$ 67	$ 13
1980	80	42	38
1981	80	11	69
1982	80	41	39
1983	80	18	62
1984	80	18	62
1985	80	6	73
1986	80	3	77
1987	80	15	65
1988	80	10	70
1989	80	11	69
1990	80	13	67

(1) Assumes an assessed valuation of $14,000 (35% assessment ratio).

Source: Table 4-151.

Table 4-156

Impact on Property Tax Rates in Conneaut City Under the Income Tax Reduction Case (Thousands of 1975 Dollars)

	1983	1986	1990
Baseline Expenditure Requirement	$ 1,604	$ 1,628	$ 1,657
Impact Expenditure Requirement	272	401	477
(1) Total Expenditure Requirements	$ 1,876	$ 2,029	$ 2,134
Baseline Nonproperty Tax Revenues	$ 867	$ 878	$ 894
Impact Nonproperty Tax Revenues	217	402	352
(2) Total Nonproperty Tax Revenues	$ 1,084	$ 1,280	$ 1,246
Facility-Related Assessed Valuation	$126,400	$107,300	$174,600
Baseline Assessed Valuation	71,977	72,957	74,286
Secondary Development-Related Assessed Valuation	11,922	13,938	22,396
(3) Total Assessed Valuation	$210,299	$194,195	$271,282
(4) Amount to be raised by Property Tax*	$ 792	$ 749	$ 888
(5) New Property Tax Rate**	$ 3.80	$ 3.90	$ 3.30
Baseline Property Tax Rate	5.70	$ 5.70	$ 5.70
Tax Rate Increase (Decrease) as a Percent of Baseline Rate	(33%)	(32%)	(42%)

* (4) = (1) - (2)
**(5) = (4) ÷ (3)

Note: Tax rate in dollars per thousand of assessed valuation. Valuations are estimated for the year in which the tax would be paid.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model; United States Steel Corporation; Arthur D. Little, Inc. estimates.

Table 4-157

Impact on Property Tax Revenues in Conneaut City Under the Income Tax Rate Reduction Case

	1983	1986	1990
Property Tax Revenues from Baseline Property	$ 274	$ 285	$ 245
Property Tax Revenues from Secondary Development	45	54	73
Property Tax Revenues from Proposed Lakefront Facility	480	418	576
Total Property Tax Revenues	$ 799	$ 757	$ 894
Facility-Related as a Percent of Total Property Tax Revenues	60%	55%	64%
Total Revenues	$1,876	$2,029	$2,134
Facility-Related as a Percent of Total Revenues	26%	21%	27%

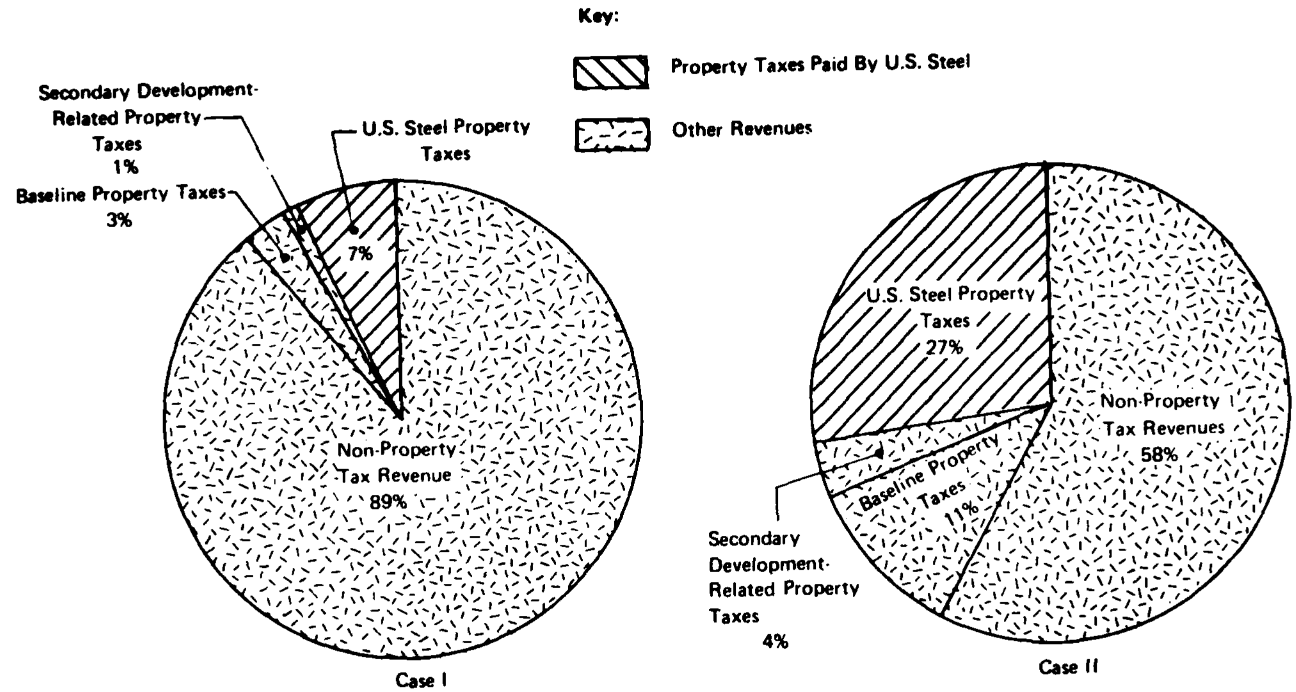
Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model; United States Steel Corporation.

Table 4-158

Impact on Revenues by Source in Conneaut City
Under the Income Tax Rate Reduction Case
(Thousands of 1975 Dollars)

	1983	1986	1990
Baseline Nonproperty Tax Revenues	$ 867	$ 878	$ 894
Total Property Tax Revenues (Impact and Baseline)	792	749	888
Impact-Related Nonproperty Tax Revenues	217	402	352
Income Tax	200	377	320
Motor Vehicle License Tax	8	12	15
Miscellaneous Revenues	9	13	17
Total Revenues	$1,876	$2,029	$2,134

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model; United States Steel Corporation.



Note: Case I is the maximum property tax rate reduction case
Case II is the income tax rate reduction case

Source: Tables 4-153 and 4-157

FIGURE 4–32 TOTAL OPERATING REVENUES BY SOURCE IN CONNEAUT CITY – 1990

of the city of Conneaut. In deciding between property tax rate reduction and income tax rate reductions, local officials and citizens would have to assess the potential configuration of the city income tax base. The applicant's total taxable net income apportionable to its Conneaut operations would also be subject to the income tax, so the potential effect of an income tax rate reduction on this revenue source would also have to be evaluated. Another consideration is the fact that Conneaut levies its income tax on a place of work basis, thus much of the city income tax revenues would come from nonresidents who work at the lakefront facility. Proper evaluation of all these issues would have to be made to insure that the selected tax policy benefits the community over the long run.

Springfield Township

4.309
Under the current structure in Springfield Township, local income tax revenues would be sufficiently high so that no income from property taxes would be needed to meet expenditure requirements. The township could, therefore, eliminate its property tax altogether (refer to Table 4-159). The income tax alone would yield revenues that greatly exceed the estimated expenditure requirements. Alternatively, the community could eliminate its income tax instead of reducing the property tax. Both are discussed below.

4.310
Property Tax Elimination Case. (Case I). Springfield Township would receive income tax revenues from its residents who work at the lakefront facility (construction and operations), and from lakefront facility employees who reside in Ohio but work on the Pennsylvania portion of the facility site. The former would pay a tax to the township equal to 0.4 percent of their salary; while the latter workers would pay the nonresident rate which equals one percent of their salary. In 1981, the year of peak construction activity, the township would receive nearly $300,000 in income tax revenues which is nearly three times the total revenues received by the township in 1975 (refer to Table 4-160). In 1986, income tax revenues from Phase II of construction and from operations would be $464,000. By 1990, after the construction activity has terminated, income tax revenues would be $433,000. The additional income tax revenues would be sufficiently great enough that there would be no need for property tax revenues (refer to Table 4-159). However, elimination of the $2.20 property tax would result in minimal savings to homeowners, i.e., only $18.00 on a $40,000 home. Since income tax revenues in Springfield would be high, even with the elimination of the property tax, the township's total revenues would be nearly twice its projected expenditure requirements. For instance, the township could spend an additional $307,000 in 1990 and still eliminate the property

Table 4-159

Impact on Property Tax Rates in Springfiled Township -- 1979-1990
(Thousands of 1975 Dollars)

	1979			1981			1986			1990		
	Tax Under Impact Conditions	Tax Under Baseline Conditions	Tax Reduction	Tax Under Impact Conditions	Tax Under Baseline Conditions	Tax Reduction	Tax Under Impact Conditions	Tax Under Baseline Conditions	Tax Reduction	Tax Under Impact Conditions	Tax Under Baseline Conditions	Tax Reduction
Ohio Local Study Area(1)												
Conneaut City (2)	$ 67	$ 80	$ 13	$ 11	$ 80	$ 69	$ 3	$ 80	$ 77	$ 13	$ 80	$ 67
Conneaut Area City School District	421	423	2	445	396	(49)*	279	332	53	218	314	96
Ashtabula County	53	53	0	53	53	0	43	53	10	39	53	14
Total	$ 541	$ 556	$ 15	$ 509	$ 529	$ 20	$ 325	$ 465	$ 140	$ 270	$ 447	$ 177
Pennsylvania Local Study Area(1)												
Springfield Township(2)	$ 0	$ 18	$ 18	$ 0	$ 18	$ 18	$ 0	$ 18	$ 18	$ 0	$ 18	$ 18
Northwestern School District	547	556	9	309	529	220	358	493	135	420	489	69
Erie County	97	98	1	98	98	0	96	98	2	96	98	2
Total	$ 644	$ 672	$ 28	$ 407	$ 645	$ 238	$ 454	$ 609	$ 155	$ 516	$ 605	$ 89

(1) Assumes an assessment ratio of 35% in Ohio and 20% in Pennsylvania.

(2) Assumes maximum tax rate reduction case.

* Increase

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-160

Impact on Local Income Tax Revenues in Springfield Township -- 1979-1990
(Thousands of 1975 Dollars)

	Construction	Operations	Total
1979	$ 32	$ 0	$ 32
1980	101	0	101
1981	204	89	293
1982	66	245	311
1983	0	245	245
1984	16	245	261
1985	79	245	324
1986	133	331	464
1987	25	433	458
1988	0	433	433
1989	0	433	433
1990	0	433	433

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

tax. This money could be used to fund sewage system and water system costs which might otherwise be financed from user charges. For example, the estimated annual principal and interest cost for the construction of a central groundwater supply system for Springfield would average about $110,000. One rationale for financing these costs out of income tax revenues might be that it would shift some of the burden of financing these costs on to nonresidents who would work in the Springfield portion of the lakefront facility and pay income taxes to the township. Since income tax revenues would greatly exceed total expenditure requirements, the tax rate could probably be lowered without creating a need for revenues from the property tax. For most years of the projection period, the income tax rate could probably be reduced by half without property tax revenues. For example, in 1990, assuming that income tax rates are reduced by half, total nonproperty tax revenues would still exceed expenditure requirements by over $50,000.

4.311
Income Tax Elimination Case (Case II). Alternatively, the township could eliminate its income tax completely, once substantial amounts of lakefront facility property are added to its tax base. In that case, the property tax would become the principal revenue source for the township with the applicant financing the majority of the expenditures. If the income tax were eliminated after the U.S. Steel property has been added to the tax base, the rate in 1983 would increase to over $4.00, $6.00 in 1986, and then down to $4.00 in 1990 (refer to Table 4-161). For a $40,000 home, the tax in 1986 would be $50 compared to a tax of $18 under the projected baseline rate, and no tax under Case I. Homeowners would be paying higher property taxes in this case, but some taxpayers might save at least that much on their income taxes. A taxpayer earning $15,000 per year would save $60 if the income tax were eliminated which would be more than the increase in his property tax. Under this case, the applicant's property taxes would account for about 70 percent of all the property tax revenues collected by the township and between 37 percent and 48 percent of the township's total revenues. The eventual effect of plant-related development on property and income tax rates in Springfield will depend on the resolution of political and economic issues that are affected by tax rate considerations.

East Springfield Borough

4.312
No part of the proposed lakefront facility would be located in East Springfield Borough, so the borough would not receive tax benefits that would accrue to Springfield Township. The fiscal implications of the proposed development for East Springfield Borough would result from the interaction of plant-related expenditure requirements and

Table 4-161

Impact on Property Tax Rates in Springfield Township
Under the Income Tax Elimination Case
(Thousands of 1975 Dollars)

	1983	1986	1990
Baseline Expenditure Requirement	$ 123	$ 129	$ 136
Impact Expenditure Requirement	82	192	138
(1) Total Expenditure Requirements	$ 205	$ 321	$ 274
Baseline Nonproperty Tax Revenues	81	86	91
Impact Nonproperty Tax Revenues	12	18	22
(2) Total Nonproperty Tax Revenues	$ 93	$ 104	$ 113
Facility-Related Assessed Valuation	$ 18,200	$ 25,000	$ 25,000
Baseline Assessed Valuation	4,723	4,954	5,216
Secondary Development-Related Assessed Valuation	3,436	5,230	6,391
(3) Total Assessed Valuation	$ 26,359	$ 35,184	$ 36,607
(4) Amount to be Raised by Property Tax*	112	217	161
(5) Impact Property Tax Rate**	$4.20	$6.20	$4.40
Baseline Property Tax Rate	$2.20	$2.20	$2.20
Tax Rate Increase (Decrease) as a Percent of Baseline Tax Rate	110%	210%	100%

Note: Tax rates in dollars per thousand of assessed valuation.

*(4) = (1) - (2)

**(5) = (4) ÷ (3)

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model; United States Steel Corporation; Arthur D. Little, Inc. estimates.

property and income tax revenues from new residents who would work at the lakefront facility. The eventual tax rate effects of plant-related development on property tax rate in East Springfield would depend on the distribution of new resident population between the township and the borough. This distribution has not been estimated. It is unlikely the overall number of new residents who locate in East Springfield Borough would adversely affect the property tax rates. The borough could continue without a police force and could continue to rely on a volunteer fire department. Expenditures for law enforcement services have been estimated for Springfield Township since this community would be better able to make these expenditures. The expenditures for the other services the borough would have to supply to its new residents would include general Government, park maintenance and maintenance and construction of improved roads and storm sewers. Since the latter services are somewhat discretionary, the borough could adjust its expenditures so that they would be financed out of property and income tax revenues from new residents, thus obviating the need for a tax rate increase. If the borough should choose to participate in a cooperative law enforcement and fire protection service arrangement with the township, its tax rate might be affected depending on the financial nature of the agreement.

School Districts

4.313
Conneaut Area City School District. The Conneaut School District could substantially reduce its property tax rates as a result of plant-related development. The greatest reductions would occur late in the projection period after the facility-related assessed valuation has been added to the District's property tax base. During 1979 and 1980, the proposed development would have little effect on property tax rates. For these years, plant-related expenditure requirements would be small (i.e., $6,000 in 1979 and $91,000 in 1980) resulting in property tax rates that would approximate the projected baseline rates (refer to Table 4-162).

4.314
In 1981, the District rate would have to increase by $3.50 to finance the estimated expenditure requirements (refer to Table 4-162). The principal reason for the increase is the need to finance debt service costs for the construction of a senior high school addition before substantial property tax revenues accrue to the District from the proposed lakefront facility. The debt service cost in 1981 resulting from the amortization of the total construction cost of $1.5 million would be $143,000. Also, in 1981, the District would incur additional operating expenditures of $286,500 as U.S. Steel plant operation workers and their families begin to move into the District.

Table 4-162

Impact on Property Tax Rates in the Conneaut Area City School District -- 1979-1990 (Thousands of 1975 Dollars)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Baseline Expenditure Requirement	$ 4,015	$ 3,930	$ 3,854	$ 3,782	$ 3,706	$ 3,634	$ 3,566	3,501	$ 3,482	$ 3,465	$ 3,446	$ 3,413
Impact Expenditure Requirement	6	91	430	1,021	993	1,031	1,123	1,556	1,948	1,891	1,868	1,947
(1) Total Expenditure Requirements	$ 4,021	$ 4,021	$ 4,284	$ 4,803	$ 4,699	$ 4,665	$ 4,689	5,057	$ 5,430	$ 5,356	$ 5,314	$ 5,360
Baseline Nonproperty Tax Revenues	$ 1,716	$ 1,702	$ 1,581	$ 1,676	$ 1,665	$ 1,653	$ 1,640	$ 1,636	$ 1,631	$ 1,628	$ 1,624	$ 1,619
Impact Nonproperty Tax Revenues	1	23	85	239	- 399	- 625	- 600	- 553	- 458	- 513	- 597	- 568
(2) Total Nonproperty Tax Revenues	$ 1,717	$ 1,725	$ 1,766	$ 1,915	$ 1,266	$ 1,028	$ 1,040	$ 1,083	$ 1,173	$ 1,115	$ 1,027	$ 1,051
Facility Related Assessed Valuation	$ 500	$ 500	$ 500	$ 45,800	$126,400	$117,700	$112,600	$107,300	$129,900	$193,000	$183,700	$174,600
Secondary Development Related Assessed Valuation	47	399	1,897	4,900	11,922	12,020	12,670	13,938	17,070	21,787	21,794	22,396
Baseline Assessed Valuation	75,882	76,452	76,798	77,144	77,494	77,844	78,196	78,550	78,905	79,262	79,620	79,980
(3) Total Assessed Valuation*	$ 76,429	$ 77,351	$ 79,195	$127,844	$215,816	$207,564	$203,466	$199,788	$225,875	$294,049	$285,114	$276,976
(4) Amount to be Raised by Property Tax**	$ 2,304	$ 2,296	$ 2,518	$ 2,888	$ 3,433	$ 3,637	$ 3,649	$ 3,974	$ 4,257	$ 4,241	$ 4,287	$ 4,309
(5) Impact Tax Rate***	$ 30.10	$ 29.70	$ 31.80	$ 22.60	$ 15.90	$ 17.50	$ 17.90	$ 19.90	$ 18.80	$ 14.40	$ 15.00	$ 15.60
Baseline Tax Rate	$ 30.30	$ 29.10	$ 28.30	$ 27.30	$ 26.30	$ 25.40	$ 24.60	$ 23.70	$ 23.50	$ 23.20	$ 22.90	$ 22.40
Tax Rate Increase (Decrease) as a Percent of Baseline Tax Rate	0.7%	2%	12%	(17%)	(40%)	(31%)	(27%)	(16%)	(20%)	(38%)	(34%)	(30%)

*Valuations are estimated for the year in which the tax would be paid
**(4) = (1) - (2)
***(5) = (4) ÷ (3). Tax rates in dollars per thousand of assessed valuation

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model; United States Steel Corporation; Arthur D. Little, Inc. estimates.

Table 4-163

Property Tax for a $40,000 Home[1] in the Conneaut Area City School District -- 1979-1990

	Tax Under Baseline Conditions	Tax Under Impact Conditions	Tax Reduction Resulting from Impact-Related Development
1979	$ 423	$ 421	$ (2)[2]
1980	406	416	(10)[2]
1981	396	445	(49)[2]
1982	381	316	65
1983	368	223	145
1984	356	245	111
1985	344	251	93
1986	332	279	53
1987	328	263	65
1988	332	202	130
1989	319	210	109
1990	314	218	96

(1) Assumes an assessed valuation of $8,000 (20% assessment ratio).

(2) Increase

Source: Table 4-162.

4.316
Beginning in 1987, when the assessed valuation of Step II lakefront facility property is added to the property tax base of the District, the tax rate would begin to decline. In 1988, the assessed valuation of the proposed lakefront facility would increase to $193 million and the tax rate would decline to about $14.40 which is about a 38 percent reduction from the projected baseline rate, and the lowest rate for the projection period. For the final two years of the projection period, when the tax base declines slightly due to the depreciation of U.S. Steel machinery and equipment, the tax rate would rise to over $15.00. The tax rates shown in Table 4-162 would result in major reductions in the taxes paid by homeowners. For a single-family home, with a market value of $40,000, the 1990 property tax would be about $96 lower because of U.S. Steel-related development (refer to Table 4-163).

4.317
Once construction is completed and the lakefront facility valuation is added to the tax base, the applicant would be providing the major portion of the District operating revenues. By 1990, the final year of the projection period, U.S. Steel would pay $2.7 million in property taxes on the lakefront facility. This amount would comprise nearly two-thirds of the total property tax revenues for the District during that year and about one half of the total operating revenues (refer to Table 4-164 and Figure 4-33). The salutory tax effects of the addition of U.S. Steel property to the tax base of the District are moderated somewhat by a decline in State school aid. State school aid distributions per student are very sensitive to the amount of taxable property in the District. Since Conneaut would have a large increase in taxable property per student the school district would actually lose school aid even though enrollment increases. The loss begins in 1983 even though the tax base increases in 1982, since school aid amounts are computed on the assessed valuation of the preceding year (refer to Table 4-165).

4.318
Over the 1979 to 1990 projection period, State basic aid would decline by approximately 75 percent from $1,148,000 in 1979 to about $300,000 in 1990. As a result of declining enrollments under projected baseline conditions, a slight decrease (eight percent) in the total State basic aid would occur (from $1,148,000 in 1979 to $1,051,000 in 1990) (refer to Table 4-165). The difference between baseline and plant-induced levels is indicated most clearly by comparing amounts of aid per pupil. The table shows that baseline aid is projected to rise slightly from $372/pupil in 1979 to $392/pupil in 1990. However, as a result of plant-related development, aid levels would drop from $372/pupil in 1979 to $75/pupil in 1990. The major

Table 4-164

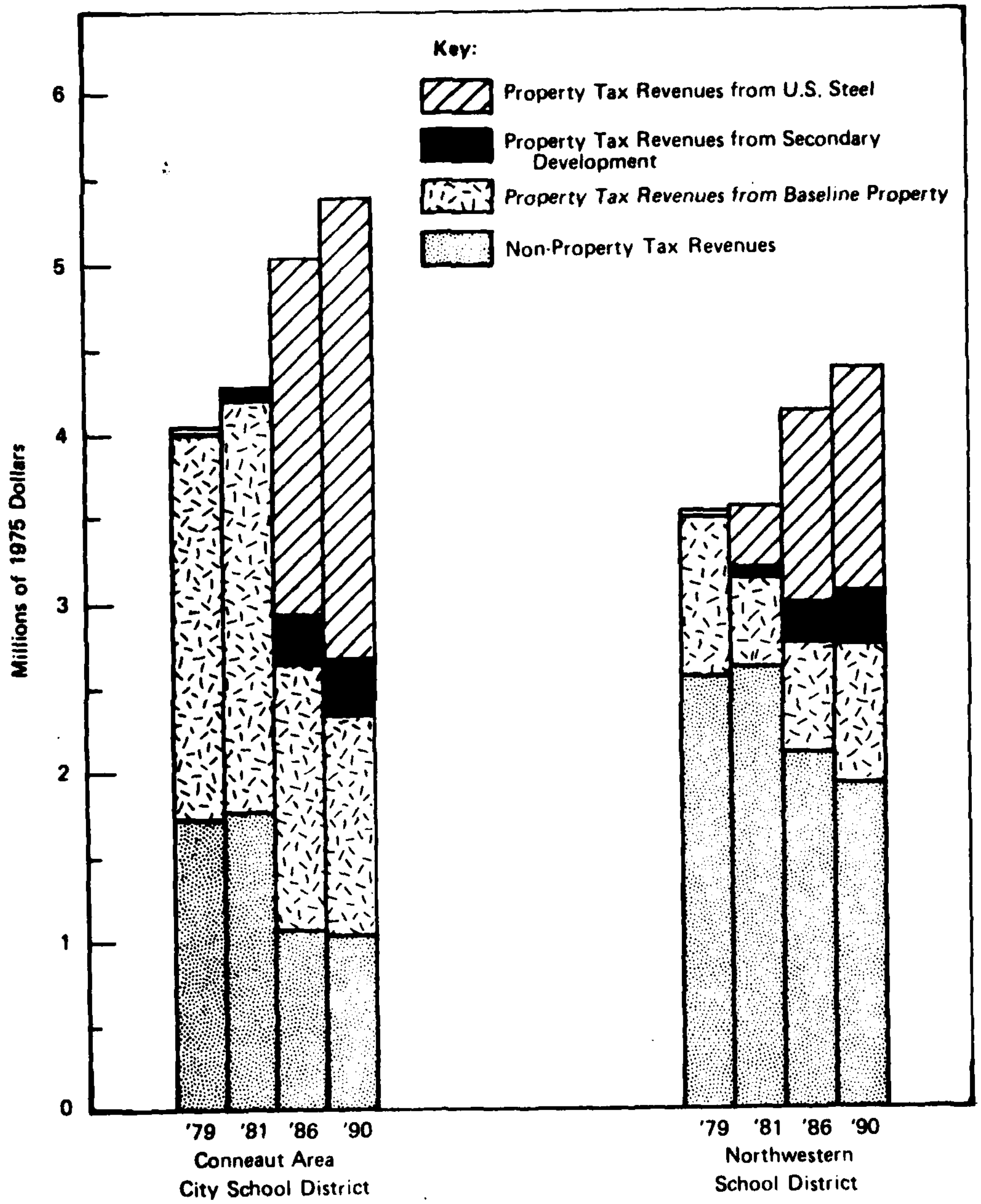
Impact on Property Tax Revenues in the Conneaut Area City School District -- 1979-1990[1]
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Property Tax Revenues from Baseline Facilities	$ 2,284	$ 2,442	$ 1,563	$ 1,248
Property Tax Revenues from Secondary Development	1	60	277	349
Property Tax from Proposed Lakefront Facility	15	16	2,135	2,723
Total Property Tax Revenues	$ 2,300	$ 2,518	$ 3,975	$ 4,320
Facility-Related as a Percent of Total Property Tax Revenues	(2)	1%	54%	63%
Total Revenues	$ 4,021	$ 4,284	$ 5,057	$ 5,360
Facility-Related Property Tax Revenues as a Percent of Total Revenues	(2)	(2)	42%	51%

(1) All revenues estimated using new tax rates from Table 4-156.

(2) Less than 0.5%

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.



Source: Tables 4-164, 4-166, 4-169, and 4-171

FIGURE 4-33 TOTAL OPERATING REVENUES OF SCHOOL DISTRICTS IN THE LOCAL STUDY AREA – 1979–1990

Table 4-165

Impact on State Basic Aid Revenues in the Conneaut Area City School District -- 1979-1990(1)

	Assessed Valuation (In Millions) Impact	Baseline	Val. Total	Impact Assessed Value/ Pupil Per Mill (Pupils)(2)	Baseline Assessed Value/ Pupil Per Mill (Pupils)	Basic Aid (in $1,000's) Impact	Baseline	Impact Aid Per Pupil(2)	Baseline Aid Per Pupil
1979	$ 0	$ 75.4	$ 75.4	$ 24.40 (3090)	$ 24.40 ([illegible])	$ 1,148.4	$ 1,148.4	$ 372	$ 372
1980	0.5	75.9	76.4	24.70 (3095)	25.10 (3027)	1,145.4	1,133.6	370	375
1981	0.9	76.5	77.4	24.20 (3195)	25.80 (2965)	1,161.7	1,112.7	364	375
1982	2.4	76.8	79.2	21.90 (3615)	26.40 (2910)	1,235.7	1,107.6	342	381
1983	50.7	77.1	127.8	36.10 (3540)	27.00 (2855)	589.4	1,095.8	166	384
1984	138.3	77.5	215.8	61.30 (3520)	27.70 (2800)	347.4	1,084.8	99	387
1985	129.7	77.8	207.5	59.60 (3480)	28.30 (2750)	357.4	1,072.1	103	390
1986	125.3	78.2	203.5	56.40 (3610)	28.60 (2735)	377.6	1,067.6	105	390
1987	121.2	78.6	199.8	51.00 (3920)	28.90 (2720)	417.6	1,063.0	107	391
1988	147.0	78.9	225.9	58.40 (3870)	29.10 (2710)	364.7	1,060.0	94	391
1989	214.8	79.3	294.1	76.30 (3845)	29.40 (2695)	278.4	1,055.5	72	392
1990	205.5	79.6	285.1	73.10 (3905)	29.70 (2680)	291.3	1,051.0	75	392

(1) Based on [illegible] revenues are received by school district.

(2) Sum of baseline and impact-related assessed valuation per pupil per mill of tax rate.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SEIMPACT IV Model; Education Services baseline; Education Services impact; Arthur D. Little, Inc. estimates.

influence on State aid accounting for varying aid levels is the projected change in assessed valuation relative to change in enrollments. Although Conneaut enrollments would increase by about 26 percent over the 1979-1990 study period, the total assessed valuation increases by about 280 percent during the same period. The effect is a higher ratio of assessed valuation to pupils (refer to Table 4-165). Under baseline conditions, the expected decline in baseline enrollments (13 percent) during the 1979-1990 period accompanied by the slightly increasing assessed valuation causes the baseline assessed valuation per pupil to increase.

4.319
These estimates of projected revenues are based on the 1975 State aid formula, which uses the 1975 aid level as a basic funding guarantee to each school district. The formula will be in effect until 1980 when the Ohio Legislature is expected to reformulate the basic aid calculation. In the school aid formula, changes by the Legislature may result in school aid distributions to Conneaut that differ from these estimates and result in different tax rate effects. The district would receive additional Federal and State categorical aid as enrollment increases (refer to Table 4-166). However, the loss of the State basic instructional aid would be so large that there would be a loss of nonproperty tax revenues (refer to Table 4-162 and Table 4-166). The tax rates shown in Table 4-162 are based on the assumption that expenditures per student would remain constant throughout the projection period at $1,250. However, if the District chose to expand its programs, thereby increasing expenditures beyond those estimated, the tax rate declines would be less than those indicated on Table 4-162.

4.320
Northwestern School District. The Northwestern School District, like Conneaut, could substantially reduce its property tax rates as a result of plant-related development. Rate reductions would not be as large as in Conneaut because Pennsylvania does not tax plant machinery, equipment and inventories. In 1979 and 1980, the overall reduction in the rate would be small (refer to Table 4-167). Although plant-related expenditure requirements are low for those years, revenues accrue from the income and property taxes paid by construction workers who would reside in the District. The tax rate for the Northwestern School District would reach its lowest point in 1981 when it would be $38.60 or 41 percent less than the baseline tax rate. The rate would increase after 1982 because of the effects of reduced school aid revenues. As in Conneaut, Northwestern would lose school aid as the valuation of lakefront facility property is added to its tax base. Since school aid amounts are computed on the basis of the assessed valuation from the preceding year, the addition of $18.2 million of U.S. Steel property to the tax base in 1982 does not

Table 4-166

Impact on School District Nonproperty Tax Revenues
in the Conneaut Area City School District -- 1979-1990
(Thousands of 1975 Dollars)

Total	1979	1981	1986	1990
Basic Instruction Aid	$ 0	$ 49.0	$ -690.0	$ -759.7
State Categorical Aid	0.6	29.5	112.7	157.7
Federal Categorical Aid	0.1	6.4	24.4	34.2
Total	$ 0.7	$ 84.9	$ -552.9	$ -567.8

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-167

Impact on Property Tax Rates in the Northwestern School District -- 1979-1990
(Thousands of 1975 Dollars)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Baseline Expenditure Requirement	$ 3,517	$ 3,473	$ 3,407	$ 3,380	$ 3,356	$ 3,330	$ 3,294	$ 3,310	$ 3,326	$ 3,341	$ 3,359	$ 3,412
Impact Expenditure Requirement	0	46	161	481	489	526	549	810	980	953	941	980
(1) Total Expenditure Requirements	$ 3,517	$ 3,519	$ 3,568	$ 3,861	$ 3,845	$ 3,856	$ 3,843	$ 4,120	$ 4,306	$ 4,294	$ 4,300	$ 4,392
Baseline Nonproperty Tax Revenues	$ 2,586	$ 2,548	$ 2,495	$ 2,472	$ 2,448	$ 2,424	$ 2,404	$ 2,398	$ 2,408	$ 2,412	$ 2,420	$ 2,452
Impact Nonproperty Tax Revenues	1	34	125	- 21	- 471	- 444	- 433	- 290	- 484	- 553	- 553	- 531
(2) Total Nonproperty Tax Revenues	$ 2,587	$ 2,582	$ 2,620	$ 2,451	$ 1,977	$ 1,980	$ 1,971	$ 2,108	$ 1,924	$ 1,859	$ 1,867	$ 1,921
Facility-Related Assessed Valuation	$ 200	$ 200	$ 9,600	$ 18,200	$ 18,200	$ 18,200	$ 18,200	$ 25,000	$ 25,000	$ 25,000	$ 25,000	$ 25,000
Secondary Development-Related Assessed Valuation	17	356	1,163	3,282	3,437	3,704	4,117	5,231	6,342	6,323	6,390	6,393
Baseline Assessed Valuation	13,400	13,600	13,800	14,000	14,200	14,400	14,600	14,800	15,000	15,200	15,500	15,700
(3) Total Assessed Valuation*	$ 13,617	$ 14,156	$ 24,563	$ 35,482	$ 35,837	$ 36,304	$ 36,917	$ 45,031	$ 46,342	$ 46,523	$ 46,890	$ 47,093
(4) Amount to be Raised by Property Tax**	$ 930	$ 937	$ 948	$ 1,410	$ 1,868	$ 1,876	$ 1,872	$ 2,012	$ 2,382	$ 2,435	$ 2,433	$ 2,471
(5) Impact Property Tax Rate***	$ 68.40	$ 66.20	$ 38.60	$ 39.70	$ 52.10	$ 51.70	$ 50.70	$ 44.70	$ 51.40	$ 52.30	$ 51.90	$ 52.50
Baseline Property Tax Rate	$ 69.50	$ 68.00	$ 66.10	$ 64.90	$ 64.00	$ 62.90	$ 61.00	$ 61.60	$ 61.20	$ 61.10	$ 60.60	$ 61.10
Tax Rate Increase (Decrease) as a Percent of Baseline Tax Rate	(2%)	(3%)	(41%)	(39%)	(19%)	(18%)	(17%)	(27%)	(16%)	(14%)	(14%)	(14%)

*Valuations are estimated for the year in which the tax would be paid.

**(4) = (1) - (2)

***(5) = (4) - (3). Tax rate in dollars per thousand of assessed valuation

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model; United States Steel Corporation; Arthur D. Little, Inc. estimates.

affect school aid until 1983. Thus, the effect of the increased tax base will be to lower the property tax rate in 1981 and 1982, but to raise it in 1983. In 1986, the tax rate drops to $44.70 because the completion of Step II of the lakefront facility would add $7 million more to the District's tax base. The rate would rise in 1987 to $51.40 because State school aid declines as a result of the 1986 tax base increase, and also because expenditures would increase by $200,000 to accommodate the children of the Step II operations workers who move into the District.

4.321
The Northwestern School District would need an elementary school addition in 1986, at a cost of about $1.4 million. The annual amortized cost would be $128,300 in 1986. These costs are partly offset, however, by a State "rental subsidy." In 1986, the subsidy is estimated to be $24,900. Northwestern's tax rate would also be favorably affected by income tax revenues from its new residents, most of whom would work at the lakefront facility. Revenue from this source would reach $58,000 by 1990. Overall, the tax rates indicated on Table 4-167 would result in reduction in the taxes paid by homeowners compared to the baseline. For a single-family home with a market value of $40,000, the 1990 property tax would be about $70 lower because of impact-related development (refer to Table 4-168). As a result of the addition of U.S. Steel property to the tax base, property tax payments for the lakefront facility would constitute a major portion of the District operating revenues. In 1990, U.S. Steel would pay about $1.3 million in property taxes to the Northwestern School District. This amount would equal more than half of the District's property tax revenues and more than one quarter of its total operating revenues (refer to Table 4-169 and Figure 4-33). If the District chooses to spend more than the amount indicated on Table 4-152, the tax rate would be higher than is indicated on the table, and the tax paid by U.S. Steel as well as other property owners would be higher.

4.322
Another alternative available to the District would be to lower or eliminate its income tax, resulting in smaller reduction in the property tax rate. For example, if Northwestern eliminated its income tax in 1990, the property tax rate would be about $57.70 instead of $52.50. In that case, a single-family homeowner would pay $462 in taxes instead of $420 on a $40,000 home. The basis for evaluating the benefits of each tax rate alternative would be the same as for Springfield Township and would involve a comparison of the benefits of lower payroll taxes vs. lower property taxes and consideration of the applicant's contribution to total District operating revenues. The eventual tax rate decision would probably reflect the fact that only residents of the District would pay the

Table 4-168

Property Tax for a $40,000 Home in the Northwestern School District -- 1979-1990[1]

Year	Tax Under Baseline Conditions	Tax Under Impact Conditions	Tax Reduction Resulting from Impact-Related Development (Increase)
1979	$ 556	$ 547	$ 9
1980	544	530	14
1981	529	309	220
1982	519	318	201
1983	512	417	95
1984	504	414	90
1985	488	406	82
1986	493	358	135
1987	490	411	79
1988	489	418	71
1989	485	415	70
1990	489	420	69

(1) Assuming an assessed valuation of $8,000 (20% assessment ratio)

Sources: Table 4-152.

Table 4-169

Impact on Property Tax Revenues in the Northwestern School District -- 1979-1990(1)

	1979	1981	1986	1990
Property Tax Revenues from Baseline Property	$ 916	$ 533	$ 662	$ 824
Property Tax Revenues From Secondary Development	0	45	233	335
Property Tax From Proposed Lakefront Facility	14	370	1,118	1,313
Total Property Tax Revenues	$ 930	$ 948	$2,013	$2,472
Facility Related as a Percent of Total Property Tax Revenues	2%	39%	56%	53%
Total Revenues	$3,517	$3,568	$4,120	$4,392
Facility Related Property Tax Revenues as a Percent of Total Revenues	*	10%	27%	30%

(1) Property tax revenues are estimated using the impact-related property tax rates and assessed valuations from Table 4-152.

*Less than 0.5%.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

school income tax, unlike the township, where nonresidents (i.e., Ohio residents) who work in the township would be subject to the tax. As in the Conneaut School District, the tax rates resulting from plant-related development reflect the loss of State school aid. During the period 1987 to 1990, State basic aid to Northwestern would be reduced by approximately $700,000 which is more than 50 percent less than under baseline conditions (refer to Table 4-170). The reduction is caused by impacts on the two major components of the State aid formula: namely, market valuation and enrollments. With the 250 percent increase in market valuation from 1979 to 1990 (primarily the result of the addition of U.S. Steel property to the tax base) and a simultaneous 27 percent increase in plant-induced enrollments, market value per pupil would rise. Relative to the State market value per pupil, which is assumed constant at the 1975 level, the increasing local district market value per pupil causes the State aid ratio to decline. For example, under plant-related conditions, the estimated State aid ratio for Northwestern School District would decline from 0.7173 in 1979 to 0.2088 in 1990 (refer to Table 4-170). On a per pupil basis baseline aid drops from $630 per pupil in 1979 to $580 per pupil in 1990, while plant-related aid per pupil drops from 30 in 1979 to $180 in 1990.

4.323
As indicated in the Education Services Impact section of Chapter Four, the Northwestern School District is expected to require a $1.35 million addition to an elementary school in 1986. Northwestern would receive a rental subsidy from the State to assist in the financing of the construction. The amount of payments subsidized by the State is estimated according to the current Pennsylvania formula which applies the percentage of the construction costs eligible for State reimbursement and the State aid ratio for Northwestern School District to the annual rental payments. Elementary school construction costs are assumed eligible for a maximum of 60 percent reimbursement by State aid. In 1986 the State aid would constitute 20 percent of the total rental payment due, and drop to about 12 percent between 1987 and 1990. The rental schedule, shown in Table 4-171 is based on the assumption that construction would begin in 1986. Under these circumstances, the Northwestern School District would be responsible for a net rental payment of approximately $100,000 a year during 1986-1990. In 1986, the rental payment constitutes a 15 percent increase over Northwestern's baseline rental obligations ($646,000).

4.324
Federal and State categorical aid would increase as a result of impact-related development as would income tax revenues. The income tax revenues would be equal to about $58,000 in 1990 based on a 0.6 percent payroll tax for Lakefront Plant operation workers residing in the District. Despite the increases in these revenue sources, the

Table 4-170

Impact on Basic State Aid Revenues in the Northwestern School District -- 1979-1990(1)

Year	Assessed Valuation (in $1,000's) Impact	Assessed Valuation (in $1,000's) Baseline	Market Valuation (in $1,000's) per WADM (WADM's) Impact(3)	Market Valuation (in $1,000's) per WADM (WADM's) Baseline	Impact(3) Aid Ratio	Baseline Aid Ratio	State Basic Aid (in $1,000's) Impact(2)	State Basic Aid (in $1,000's) Baseline	Impact(2) Aid Per Pupil	Baseline Aid Per Pupil
1979	$ --	$ 13,200	$ -- (2675)	$ 14.1 (2675)	$ --	.7173	$ --	$ 1,448.0	$ --	$ 630
1980	200	13,400	14.5 (2675)	14.6 (2630)	.7088	.7083	1,422.0	1,398.2	620	620
1981	550	13,600	14.9 (2720)	15.1 (2570)	.7088	.6965	1,429.6	1,342.0	620	610
1982	10,800	13,800	23.5 (2995)	15.5 (2545)	.5281	.6896	1,186.2	1,315.8	460	610
1983	21,500	14,000	34.0 (2980)	15.9 (2520)	.3173	.6819	709.2	1,289.3	280	600
1984	21,600	14,200	34.2 (2990)	16.3 (2495)	[illegible]	.6741	702.6	1,262.4	280	590
1985	[illegible]	14,400	34.7 (2990)	16.6 (2475)	.3032	.6670	679.9	1,237.6	270	590
1986	22,300	14,600	33.7 (3130)	16.9 (2490)	.3233	.6618	728.9	1,235.9	280	580
1987	30,200	14,800	38.9 (3305)	16.9 (2505)	.2189	.6615	542.6	1,242.8	190	580
1988	31,300	15,000	40.1 (3300)	17.0 (2520)	.1948	.6586	482.1	1,244.3	170	580
1989	31,300	15,200	40.2 (3305)	17.1 (2535)	.1948	.6568	482.9	1,248.7	170	580
1990	31,400	15,400	39.4 (3395)	17.0 (2585)	.2088	.6589	531.7	1,277.9	180	580

(1) On basis of year in which revenues are received.

(2) WADM is the weighted average daily membership

(3) Impact is the sum of baseline and impact-related.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; Education Services baseline; Education Services impact; SIMPACT IV Model; Arthur D. Little, Inc, estimates.

Table 4-171

State Aid for Elementary School Addition
in the Northwestern School District -- 1986-1990

	Rental Payment Due[1]	State Aid Ratio	State Subsidy	Net Payment Due
1986	$ 128,300	.3233	$ 24,900	$ 103,400
1987	125,300	.2189	16,500	108,800
1988	122,300	.1948	14,300	108,000
1989	119,300	.1948	13,900	105,400
1990	116,000	.2088	14,500	101,500

(1) Based on total construction cost of $1.35 million.

Source: Revenue Estimation Working Paper; Arthur D. Little, Inc. estimates.

District would lose nonproperty tax revenues as a result of the decline in basic instructional aid (refer to Table 4-172). This accounts for negative amounts shown in Table 4-167. The State school aid projections for Northwestern should be viewed as "worst case" estimates of the minimum probable amounts that would be received by the District. These projections are based on the assumption that the State market value per WADM will remain at the 1975 level. The combination of a constant State value and rapidly increasing tax revenues for Northwestern implies major losses of school aid revenues for the District. If the State figure increases, as has been the case for the last three years, and is likely in the future because of declining enrollments, then there would be less of a gap between the State's market value per WADM and Northwestern's. Under these circumstances, Northwestern's school aid would be greater than indicated, and the plant-related tax rates would be lower than is indicated on Table 4-167. As in Conneaut, any changes in the State school aid distribution formula would have commensurate effects on the Northwestern school aid distribution and on its tax rate.

Principal Study Area

4.325
The effects of impact-related development on property tax rates of Principal Study Area jurisdictions are estimated in the same manner as for the Local Study Area. Total revenues by source for the Coastal Communities are shown on Tables 4-173 and 4-174.

Local Governments

4.326
The tax rate increase for some municipalities would be too small to have any measurable effect on property taxpayers. However, certain municipalities could lower the property tax rate slightly because of beneficial revenue effects of induced commercial activity while others could increase. However, these increases are the result of large expenditure requirements for storm sewer construction. It is likely that the municipalities would not raise the tax rate to finance these expenditures. Rather they would probably maintain the baseline tax rate and not make the storm sewer-related expenditures.

4.327
Kingsville Township and North Kingsville Village. This area could experience substantial increases in its property tax rate, assuming the township expenditures occur as shown in Table 4-175. During 1981, the year of maximum construction impact, the tax rate would increase by $4.90, which exceeds the projected baseline by 96 percent. The tax rate increases indicated for 1979 and 1981 are primarily required for road improvements and for construction of storm sewers. These

Table 4-172

Impact on Property Tax Revenues(1) in the Northwestern School District -- 1979-1990 (Thousands of 1975 Dollars)

	1979	1981	1986	1990
Total				
Local Income Tax	$ 0.7	$ 12.0	$ 49.7	$ 58.3
Miscellaneous Taxes	0	2.9	15.1	18.7
State Basic Instructional Aid	0	87.6	-477.0	-746.2
State Categorical Aid	0	14.1	59.9	76.0
Federal Categorical Aid	0	8.8	37.4	47.5
Rental Subsidy	0	0	24.9	14.5
Total	$ 0.7	$ 125.4	$ -290.0	$ -531.2

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-173

Impact on Local Government Revenues -- 1979-1990
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Kingsville Township and North Kingsville Village				
Property Tax	$62	$107	$91	$88
Income Tax	0	0	0	0
Miscellaneous Tax	0	0	0	0
Miscellaneous Revenues	0	2	2	2
Total Revenues	$62	$107	$93	$90
Ashtabula Township				
Property Tax	$594	$635	$669	$680
Income Tax	0	0	0	0
Miscellaneous Tax	0	0	0	0
Miscellaneous Revenues	0	12	32	39
Total Revenues	$594	$647	$701	$719
Ashtabula City				
Property Tax	$787	$796	$783	$778
Income Tax	4	26	49	53
Miscellaneous Tax	0	1	2	2
Miscellaneous Revenues	0	7	9	9
Total Revenues	$791	$830	$843	$842
Saybrook Township				
Property Tax	$295	$341	$345	$363
Income Tax	0	0	0	0
Miscellaneous Tax	0	0	0	0
Miscellaneous Revenues	1	3	3	2
Total Revenues	$296	$344	$348	$365

Table 4-173 (Continued)

	1979	1981	1986	1990
Girard Township				
Property Tax	$ 17	$45	$10	$ 5
Income Tax	2	8	23	29
Miscellaneous Tax	0	0	0	0
Miscellaneous Revenues	0	8	16	19
Total Revenues	$ 19	$61	$49	$53
Fairview Township				
Property Tax	$65	$92	$68	$68
Income Tax	0	0	0	0
Miscellaneous Tax	0	2	2	1
Miscellaneous Revenues	0	2	2	2
Total Revenues	$65	$96	$72	$71
Millcreek Township				
Property Tax	$902	$943	$926	$ 960
Income Tax	7	14	34	46
Miscellaneous Tax	0	3	2	2
Miscellaneous Revenue	0	4	3	2
Total Revenues	$909	$964	$965	$1,010

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-174

Impact on School District Revenues -- 1979-1990
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Buckeye Local School District				
Property Tax	$3,357	$3,324	$3,117	$3,111
Income Tax	0	0	0	0
Miscellaneous Tax	0	0	0	0
State Basic Aid	0	18	56	67
State Categorical Aid	1	14	22	25
Federal Categorical Aid	0	3	4	5
Total	$3,358	$3,359	$3,199	$3,208
Ashtabula Area City School District				
Property Tax	$4,674	$4,376	$4,040	$3,941
Income Tax	0	0	0	0
Miscellaneous Tax	0	0	0	0
State Basic Aid	2	29	105	129
State Categorical Aid	0	13	23	25
Federal Categorical Aid	0	8	14	16
Total	$4,676	$4,426	$4,182	$4,111
Girard School District				
Property Tax	$1,103	$1,140	$1,139	$1,188
Income Tax	2	8	23	29
Miscellaneous Tax	0	4	9	11
State Basic Aid	0	21	126	139
State Categorical Aid	0	6	13	15
Federal Categorical Aid	0	1	1	1
Total	$1,105	$1,180	$1,311	$1,383
Fairview School District				
Property Tax	$1,526	$1,608	$1,417	$1,433
Income Tax	7	27	42	35
Miscellaneous Tax	0	3	3	3
State Basic Aid	0	35	60	48
State Categorical Aid	1	8	8	7
Federal Categorical Aid	0	2	2	2
Total	$1,534	$1,683	$1,532	$1,528
Millcreek School District				
Property Tax	$5,925	$5,596	$5,384	$3,706
Income Tax	7	14	34	46
Miscellaneous Tax	0	3	3	2
State Basic Aid	0	8	35	36
State Categorical Aid	1	7	5	5
Federal Categorical Aid	0	1	1	1
Total	$5,933	$5,629	$5,462	$3,796

Source: State and Local Tax Structure Baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-175

Impact on Property Tax Rates in Kingsville Township
and North Kingsville Village* -- 1979-1990
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Baseline Expenditure Requirement	$ 86	$ 88	$ 96	$ 102
Impact Expenditure Requirement	18	63	42	36
(1) Total Expenditure Requirements	$ 104	$ 151	$ 138	$ 138
Baseline Nonproperty Tax Revenues	$ 41	$ 42	$ 45	$ 48
Impact Nonproperty Tax Revenues	1	2	2	2
(2) Total Nonproperty Tax Revenues	$ 42	$ 44	$ 47	$ 50
Secondary Development-Related Assessed Valuation	$ 2	$ 1,645	$ 4,567	$ 5,303
Baseline Assessed Valuation	8,714	9,026	9,804	10,427
(3) Total Assessed Valuation	$ 8,716	$10,671	$14,371	$15,730
(4) Amount to be Raised by Property Tax**	$ 62	$ 107	$ 91	$ 88
(5) Impact Property Tax Rate***	$ 7.10	$ 10.00	$ 6.30	$ 5.60
Baseline Property Tax Rate	$ 5.10	$ 5.20	$ 5.20	$ 5.20
Tax Rate Increase (Decrease) as a Percent of Baseline Tax Rate	37%	96%	21%	8%

*Estimates based on Township data. Property tax rates are expressed in dollars per thousand of assessed valuation.
**(4) = (1) - (2)
***(5) = (4) ÷ (3)

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

expenditures account for nearly all of the $18,000 in expenditures indicated for 1979 and more than half of the $63,000 in expenditures indicated for 1981 (refer to Table 4-175). It is doubtful that the township would make expenditures that would necessitate tax rate increases of this magnitude. Instead such improvements would be postponed until later in the projection period, or simply would not be made. In any case, it is likely that these expenditure requirements would be viewed as discretionary so that the tax rate would not be increased to finance them. Without these expenditures, the impact and baseline tax rates would be approximately the same.

4.328
If North Kingsville Village data were used as the basis for analysis, there would probably be some increase in the tax rate. Expenditure requirements would be at least $15,000 higher than those indicated for Kingsville because of law enforcement expenditure requirements. The village has its own police department, while the township relies on the County Sheriff for police protection. Additional revenues available to the village but not the township would include the municipal motor vehicle license tax and the income tax. Combined, these revenue sources would yield $4,000 in 1981 based on the new population induced by the proposed plant. However, road improvement and storm sewer construction expenditures could be eliminated or postponed to avoid a tax rate increase. The law enforcement expenditures, however, could probably not be avoided so that the tax rate would probably be greater using the village rather than the township estimates. The eventual tax rate effects for this area will depend on the distribution of new resident population between the township and the village, which has not been estimated.

4.329
Ashtabula Township. Tax rate changes for Ashtabula Township amount to an increase of $0.20 in 1981, $0.20 in 1986, and a slight decrease in 1990 as shown in Table 4-176. Tax rate changes of this magnitude are too low to be significant (amounting to less than $5.00 on a $40,000 home). Since the Ashtabula Township tax base is so large relative to the plant-related expenditure requirements, these expenditures will have little effect on the township tax rate.

4.330
Ashtabula City. The plant-related effects on the Ashtabula City property tax rate would be insignificant (refer to Table 4-177). No change is indicated for 1979, and only small reductions are predicted for 1981 ($.10), 1986 ($.10), and 1990 ($.40). There are several reasons for the possible rate reduction. First, plant-related housing requirements would be met by multi-unit housing requiring very little street or storm sewer construction. Secondly, Ashtabula would receive greater property tax revenues from tangible personal

Table 4-176

Impact on Property Tax Rates in Ashtabula Township -- 1979-1990*
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Baseline Expenditure Requirement	$ 963	$ 978	$ 1,015	$ 1,044
Impact Expenditure Requirement	0	44	75	75
(1) Total Expenditure Requirements	$ 963	$ 1,022	$ 1,090	$ 1,119
Baseline Nonproperty Tax Revenues	$ 369	$ 375	$ 389	$ 400
Impact Nonproperty Tax Revenues	0	12	32	39
(2) Total Nonproperty Tax Revenues	$ 369	$ 387	$ 421	$ 439
Secondary Development-Related Assessed Valuation	$ 2	$ 655	$ 4,904	$ 6,817
Baseline Assessed Valuation	106,356	106,655	107,248	107,989
(3) Total Assessed Valuation	$106,358	$107,310	$112,152	$114,806
(4) Amount to be Raised by Property Tax**	$ 594	$ 635	$ 669	$ 680
(5) Impact Property Tax Rate***	$ 5.60	$ 5.90	$ 6.00	$ 5.90
Baseline Property Tax Rate	$ 5.60	$ 5.70	$ 5.80	$ 6.00
Tax Rate Increase (Decrease) as a Percent of Baseline Tax Rate	0%	4%	3%	(2%)

*Property Tax rates are expressed in dollars per thousand of assessed valuation.

**(4) = (1) - (2)

***(5) = (4) ÷ (3)

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-177

Impact on Property Tax Rates in Ashtabula City*
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Baseline Expenditure Requirement	$ 3,758	$ 3,704	$ 3,587	$ 3,445
Impact Expenditure Requirement	0	39	52	52
(1) Total Expenditure Requirements	$ 3,758	$ 3,743	$ 3,639	$ 3,497
Baseline Nonproperty Tax Revenues	$ 2,967	$ 2,913	$ 2,796	$ 2,654
Impact Nonproperty Tax Revenues	4	34	60	65
(2) Total Nonproperty Tax Revenues	$ 2,971	$ 2,947	$ 2,856	$ 2,719
Secondary Development-Related Assessed Valuation	$ 15	$ 1,649	$ 1,653	$ 2,226
Baseline Assessed Valuation	87,832	87,832	87,832	87,832
(3) Total Assessed Valuation	$ 87,847	$ 89,481	$ 89,485	$ 90,058
(4) Amount to be Raised by Property Tax**	$ 787	$ 796	$ 783	$ 778
(5) Impact Property Tax Rate***	$ 9.00	$ 8.90	$ 8.80	$ 8.60
Baseline Property Tax Rate	$ 9.00	$ 9.00	$ 9.00	$ 9.00
Tax Rate Increase (Decrease) as a Percent of Baseline Tax Rate	0%	(1%)	(2%)	(4%)

*Property Tax Rates are expressed in dollars per thousand of assessed valuation.
**(4) = (1) - (2)
***(5) = (4) ÷ (3)

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

property than would the other Principal Study Area jurisdictions (refer to Table 4-138). In addition, Ashtabula City would receive substantial income tax revenues from the payroll of indirect and induced employees working in the city. That payroll in 1990 would amount to $3.2 million, and based on a tax rate of 1.2 percent would result in income tax revenues of about $38,000. This amount, together with the local business income tax revenue, would produce city income tax revenues totaling over $50,000.

4.331
Saybrook Township. In Saybrook Township, plant-related development would affect property tax rates in 1981. In that year, the tax rate could increase by $.50 over the baseline amount (refer to Table 4-178). The amount of the increase is considered insignificant, since the property tax on a $40,000 home would rise by only $7.00. In 1986 and 1990 there would be no impact on the tax rate. The 1981 tax increase would yield about $40,000, of which half would go toward local street improvement and storm sewer construction (refer to Table 4-178). As in Kingsville, it is likely that the tax rate would not be increased to finance these expenditures.

4.332
Girard Area. The municipalities in the Girard area (Girard Township and Borough, Platea, and Lake City Boroughs) would experience little change in the tax rate due to plant-related development. A large increase may occur in 1981 to support storm sewer construction and other projects. The storm sewer construction expenditures indicated for 1981 and 1986 could be postponed until later in the projection period when more revenues would be available. In that case, the possible tax rate reductions indicated for 1986 and 1990 would not occur, and the rate for each year in the projection period would approximate the baseline rate. The predicted tax rate changes for the Girard area have been estimated using township data and are presented in Table 4-179. These data are considered representative for the boroughs in the Girard area, since they basically have the same tax structure as the township. However, the eventual tax rate effects for the municipalities in the Girard area will depend on the distribution of impact-related population among the municipalities in the area, which has not been estimated herein.

4.433
Fairview Township and Borough. Fairview Borough may have to increase tax rates in 1979 and 1981 (refer to Table 4-180) to fund storm sewer installation. Storm sewer construction costs would amount to $12,700 in 1979 and $28,000 in 1981, about three-fourths and two-thirds of expenditure requirements in these years, respectively. Instead of raising taxes beyond the baseline property tax rate it is likely that such improvements may be delayed or put off indefinitely at the

Table 4-178

Impact on Property Tax Rates in Saybrook Township*
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Baseline Expenditure Requirement	$ 468	$ 487	$ 535	$ 574
Impact Expenditure Requirement	4	40	14	10
(1) Total Expenditure Requirements	$ 472	$ 527	$ 549	$ 584
Baseline Nonproperty Tax Revenues	$ 176	$ 183	$ 201	$ 216
Impact Nonproperty Tax Revenues	1	3	3	2
(2) Total Nonproperty Tax Revenues	$ 177	$ 186	$ 204	$ 218
Secondary Development-Related Assessed Valuation	$ 1	$ 756	$ 1,799	$ 1,513
Baseline Assessed Valuation	68,057	70,780	77,821	83,500
(3) Total Assessed Valuation	$68,058	$71,536	79,820	$85,013
(4) Amount to be Raised by Property Tax**	$ 295	$ 341	$ 345	$ 363
(5) Impact Property Tax Rate***	$ 4.30	$ 4.80	$ 4.30	$ 4.30
Baseline Property Tax Rate	$ 4.30	$ 4.30	$ 4.30	$ 4.30
Tax Rate Increase (Decrease) as a Percent of Baseline Tax Rate	0%	12%	0%	0%

*Property Tax Rates are expressed in dollars per thousand of assessed valuation.
**(4) = (1) - (2)
***(5) = (4) ÷ (3)

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-179

Impact on Property Tax Rates in the
Girard Area -- 1979-1990*
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Baseline Expenditure Requirement	$ 199	$ 205	$ 223	$ 238
Impact Expenditure Requirement	3	44	31	34
(1) Total Expenditure Requirements	$ 202	$ 249	$ 254	$ 272
Baseline NonProperty Tax Revenues	$ 183	$ 188	$ 205	$ 219
Impact NonProperty Tax Revenues	2	16	39	48
(2) Total NonProperty Tax Revenues	$ 185	$ 204	$ 244	$ 267
Baseline Assessed Valuation	$8,030	$8,276	$ 9,020	$ 9,621
Secondary Development-Related Assessed Valuation	56	967	2,239	2,768
(3) Total Assessed Valuation	$8,086	$9,243	$11,259	$12,389
(4) Amount to be Raised by Property Tax**	17	45	10	5
(5) Impact Property Tax Rate***	$ 2.10	$ 4.90	.90	$ .40
Baseline Property Tax Rate	$ 2.00	$ 2.00	$ 2.00	$ 2.00
Impact Property Tax Rate as a Percent of Baseline Property Tax Rate	5%	145%	(55%)	(80%)

*Based on data for Girard Township

**(4)=(1)-(2)

***(5)=(4)÷(3)

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-180

Impact on Property Tax Rates in Fairview Township and Borough -- 1979-1990*
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Baseline Expenditure Requirement	$ 246	$ 256	$ 281	$ 302
Impact Expenditure Requirement	16	44	14	9
(1) Total Expenditure Requirements	$ 262	$ 300	$ 295	$ 311
Baseline Nonproperty Tax Revenues	$ 196	$ 204	$ 223	$ 240
Impact Nonproperty Tax Revenues	0	4	4	3
(2) Total Nonproperty Tax Revenues	$ 196	$ 208	$ 227	$ 243
Baseline Assessed Valuation	$26,784	$27,860	$30,622	$32,849
Secondary Development-Related Assessed Valuation	168	1,501	1,764	1,436
(3) Total Assessed Valuation	$26,952	$29,361	$32,386	$34,285
(4) Amount to be Raised by Property Tax**	$ 65	$ 92	$ 68	$ 68
Impact Property Tax Rate***	$ 2.40	$ 3.10	$ 2.10	$ 2.00
Baseline Property Tax Rate	$ 1.90	$ 1.90	$ 1.90	$ 1.90
Property Tax Rate Increase (Decrease) as a Percent of Baseline Property Tax Rate	26%	58%	11%	5%

*Based on Township estimates.

**(4) = (1) - (2)

***(5) = (4) ÷ (3)

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

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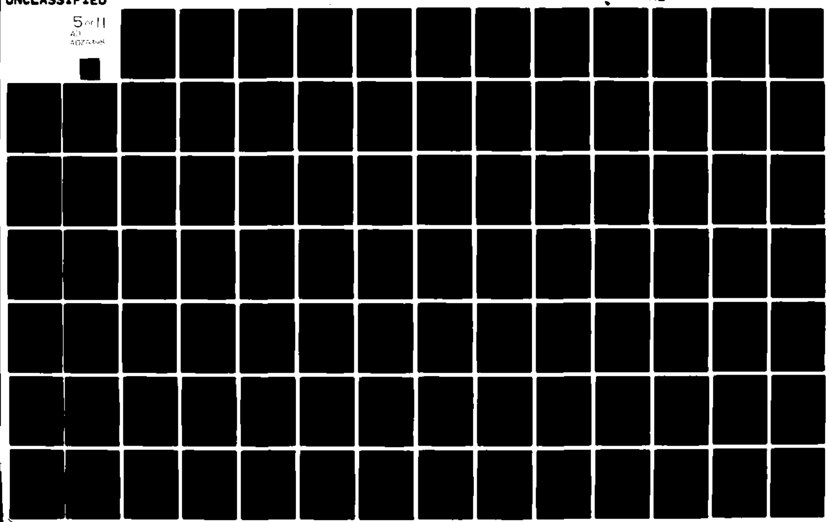


expense of continued increased drainage problems. Without plant-related storm sewer construction expenditures in 1981, property tax rates could be kept at the baseline level and still produce sufficient revenues to meet the other expenditure requirements.

4.334
Millcreek Township. Plant-related development would have no significant effect on Millcreek Township's property tax rate (refer to Table 4-181). The projected increase in 1981 would only be $.20, or three percent above the baseline rate, while a possible decrease of $.30 in 1990 would be equally insignificant. Since the Millcreek tax base is so large compared to the other municipalities, the additional expenditure requirements have little effect on the tax rate, even though Millcreek's expenditure requirements in 1981, including storm sewer costs, are greater than in Fairview and Girard.

School Districts

4.335
The effects of plant-related development on property tax rates are more significant for school districts than for local Governments in the Principal Study Area. Expenditure requirements are substantially higher for school districts and these expenditures usually cannot be reduced significantly or postponed. Generally, plant-related development would result in increases in school district property tax rates because the additional education expenditure requirements are significantly higher than the additional tax revenues that can be obtained as a result of development.

4.336
Buckeye Local School District. The largest potential property tax increase occurs in this school district. For example, in 1990 the tax rate will rise $2.40 per thousand dollars of assessed valuation representing an increase over baseline conditions of about 12 percent (refer to Table 4-182). For a single family home with a market value of $40,000 a rate increase of $2.40 would mean an increase in tax liability of about $34. Several factors contribute to the increase in the tax rate for the Buckeye District. This district would experience the largest plant-related expenditure requirements among the school districts in the Principal Study Area ($600,000 in 1990), and at current tax rates, the projected revenue growth would be insufficient to meet these expenditures. Unlike the Pennsylvania school districts, Buckeye does not have the income tax as a revenue source. In addition, it receives relatively smaller amounts of State school aid per pupil because of the large amount of taxable property. Under these conditions, Buckeye would receive less school aid for each additional plant-related pupil even though the property tax base increases due to the proposed development would be small. Most of

Table 4-181

Impact on Property Tax Rates in Millcreek Township -- 1979-1990*
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Baseline Expenditure Requirement	$ 2,831	$ 2,887	$ 3,014	$ 3,162
Impact Expenditure Requirement	19	64	24	24
(1) Total Expenditure Requirements	$ 2,850	$ 2,951	$ 3,038	$ 3,186
Baseline NonProperty Tax Revenues	$ 1,940	$ 1,978	$ 2,065	$ 2,167
Impact NonProperty Tax Revenues	8	30	47	59
(2) Total NonProperty Tax Revenues	$ 1,948	$ 2,008	$ 2,112	$ 2,226
Baseline Assessed Valuation	$120,577	$122.297	$125,982	$130,352
Secondary Development-Related Assessed Valuation	156	1,364	1,125	1,088
(3) Total Assessed Valuation	$120,733	$123,661	$127,107	$131,440
(4) Amount to be Raised by Property Tax**	$ 902	$ 943	$ 926	$ 960
(5) Impact Property Tax Rate***	$ 7.50	$ 7.60	$ 7.30	$ 7.30
Baseline Property Tax Rate	$ 7.40	$ 7.40	$ 7.50	$ 7.60
Property Tax Rate Increase (Decrease) as a Percent of Baseline Property Tax Rate	1%	3%	(3%)	(4%)

*Rates in dollars per thousand of assessed valuation.

**(4)=(1)-(2)

***(5)=(4)÷(3)

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-182

Impact on Property Tax Rates in the Buckeye Local School District -- 1979-1990*

	1979	1981	1986	1990
Baseline Expenditure Requirement	$ 4,062	$ 3,748	$ 3,356	$ 3,273
Impact Expenditure Requirement	26	337	515	600
(1) Total Expenditure Requirements	$ 4,088	$ 4,085	$ 3,871	$ 3,873
Baseline Nonproperty Tax Revenues	$ 731	$ 726	$ 673	$ 664
Impact Nonproperty Tax Revenues	0	35	81	98
(2) Total Nonproperty Tax Revenues	$ 731	$ 761	$ 754	$ 762
Secondary Development-Related Assessed Valuation	$ 8	$ 2,134	$ 6,732	$ 8,288
Baseline Assessed Valuation	130,968	131,180	131,699	131,920
(3) Total Assessed Valuation	$130,976	$133,314	$138,431	$140,208
(4) Amount to be Raised by Property Tax**	$ 3,357	$ 3,324	$ 3,117	$ 3,111
(5) Impact Property Tax Rate***	$ 25.60	$ 24.90	$ 22.50	$ 22.20
Baseline Property Tax Rate	$ 25.40	$ 23.00	$ 20.40	$ 19.80
Tax Rate Increase (Decrease) as a Percent of Baseline Tax Rate	1%	8%	10%	12%

*Property tax rates are expressed in dollars per thousand of assessed valuation.
**(4) = (1) - (2)
***(5) = (4) ÷ (3)

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

the increase in property tax base for the District would be in the residential property category and would amount to $5.5 million by 1990. No additional industrial property is expected to be added to the property tax base and only about $300,000 in commercial property. The situation in the Buckeye District is marked different from other communities where commercial and industrial property comprise major portions (over 40 percent) of the property tax base and thus finance a major share of school expenditures. Given an estimated expenditure of $1,250 per pupil, the property tax revenues from residential taxpayers would be inadequate to meet the increased expenditures. For example, the school tax at existing rates for a single-family home with a market value of $40,000 would generate less than half of the revenue needed to educate one pupil. Buckeye could avoid the property tax increase of the magnitude suggested herein, but such a step would require a reduction in expenditure per pupil with possible adverse affects on pupil/teacher ratios and educational quality.

4.337
Ashtabula Area City School District. The tax rate increases for the Ashtabula Area City School District would be four percent or less (refer to Table 4-183). In 1981, the year of maximum tax rate impact, the increase would be $.90 or only four percent more than the baseline tax rate of $25.10 (refer to Table 4-183). An increase of this magnitude would add about $14.00 to the tax on a home with a market value of $40,000. The tax rate in the Ashtabula School District would not increase as much as in Buckeye because school aid per plant-related student would be higher and its expenditure requirements lower (refer to Tables 4-182 and 4-183). Ashtabula would receive more than twice the amount of additional State and Federal aid distributed to Buckeye.

4.338
Girard School District. Plant-related development would have a small effect on the tax rate of the Girard School District. In 1981, the tax rate would rise by $1.80, or three percent. This would result in an increase of about $14 in the tax bill on a $40,000 home. For the other years of the projection period, the tax increase would be even less significant. The tax rate increases are lower than those indicated for Buckeye because impact-related enrollments and expenditure requirements are lower and because the Girard District can levy an income tax (producing nearly $30,000 in 1990) while Buckeye cannot (refer to Table 4-184). The largest tax rate impact for Girard would occur in 1981 because of the one year lag between enrollments and State school aid distributions. Since State school aid distributions are estimated on the basis of the enrollment during the preceding year, the Girard District would incur additional expenditures for plant-related students in 1981, but would receive no additional

Table 4-183

Impact on Property Tax Rates in the Ashtabula Area City School District*
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Baseline Expenditure Requirement	$ 7,711	$ 6,965	$ 6,313	$ 6,154
Impact Expenditure Requirement	6	245	434	474
(1) Total Expenditure Requirements	$ 7,717	$ 7,210	$ 6,747	$ 6,628
Baseline Nonproperty Tax Revenues	$ 3,041	$ 2,784	$ 2,565	$ 2,517
Impact Nonproperty Tax Revenues	2	50	142	170
(2) Total Nonproperty Tax Revenues	$ 3,043	$ 2,834	$ 2,707	$ 2,687
Secondary Development-Related Assessed Valuation	$ 15	$ 1,648	$ 6,230	$ 7,574
Baseline Assessed Valuation	166,410	166,704	167,492	168,017
(3) Total Assessed Valuation	$166,425	$168,352	$173,722	$175,591
(4) Amount to be Raised by Property Tax**	$ 4,674	$ 4,376	$ 4,040	$ 3,941
(5) Impact Property Tax Rate***	$ 28.10	$ 26.00	$ 23.30	$ 22.40
Baseline Property Tax Rate	$ 28.10	$ 25.10	$ 22.40	$ 21.60
Tax Rate Increase (Decrease) as a Percent of Baseline Tax Rate	0%	4%	4%	4%

*Property Tax rates are expressed in dollars per thousand of assessed valuation.
**(4) = (1) - (2)
***(5) = (4) ÷ (3)

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-184

Impact on Property Tax Rates in the Girard School District -- 1979-1990*
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Baseline Expenditure Requirement	$ 2,752	$ 2,685	$ 2,648	$ 2,721
Impact Expenditure Requirement	6	129	296	346
(1) Total Expenditure Requirements	$ 2,758	$ 2,814	$ 2,944	$ 3,067
Baseline Nonproperty Tax Revenues	$ 1,652	$ 1,634	$ 1,632	$ 1,684
Impact Nonproperty Tax Revenues	3	40	173	195
(2) Total Nonproperty Tax Revenues	$ 1,655	$ 1,674	$ 1,805	$ 1,879
Baseline Assessed Valuation	$19,522	$20,151	$22,042	$23,639
Secondary Development-Related Assessed Valuation	56	966	2,239	2,768
(3) Total Assessed Valuation	$19,578	$21,117	$24,281	$26,407
(4) Amount to be Raised by Property Tax**	$ 1,103	$ 1,140	$ 1,139	$ 1,188
(5) Impact Property Tax Rate***	$ 56.30	$ 54.00	$ 46.90	$ 45.00
Baseline Property Tax Rate	$ 56.30	$ 52.20	$ 46.10	$ 43.90
Tax Rate Increase (Decrease) as a Percent of Baseline Tax Rate	0%	3%	2%	2%

*Property tax rates are expressed in dollars per thousand of assessed valuation.
**(4) = (1) - (2)
***(5) = (4) ÷ (3)

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

school aid until the following year. The tax rate increases estimated for the District could be avoided by reducing expenditures below these estimates.

4.339
Fairview School District. As in the Girard School District, impact-related development would have a small effect on the property tax rates in the Fairview School District. In 1981, the tax rate would increase by $1.90 or more than four percent over the projected baseline rate (refer to Table 4-185). The tax on a $40,000 home would increase by $15. Although the Fairview District receives more income tax revenues than does Girard (Fairview has a one percent rate; Girard, 0.5 percent) the property tax rate effects of plant-related development are nearly the same because Fairview would receive less State school aid relative to its enrollment increase. As for the Girard District, the tax rate increases could be avoided by reducing expenditures below the levels indicated on Table 4-185.

4.340
Millcreek School District. The property tax rate in Millcreek School District would not be significantly affected by plant-related development (refer to Table 4-186). The largest increase would be $.60 in 1981, an increase of only one percent. Unlike the Fairview and Girard School Districts, Millcreek's baseline assessed valuation is so large (nearly six times that of Girard and nearly four times that of Fairview) that the additional expenditures associated with the proposed development would have little effect on the tax rate.

Regional Study Area

4.341
Ashtabula County. The Ashtabula County property tax rate would decline gradually from the baseline tax rate over the course of the projection period (refer to Table 4-187). The largest reductions would occur between 1988 and 1990 when the rate would decline by $1.00, a 26 percent reduction from the projected baseline rate (about $14 on a home with a $40,000 market value). The tax rate reductions projected would occur as facility-related assessed valuation is added to the tax base and revenues are derived from the recently-enacted county sales tax. Revenues from the latter source would amount to $102,000 in 1981, $182,000 in 1986 and $195,000 in 1990.

4.342
Erie County. The effect of plant-related development on the Erie County tax rate would be insignificant, amounting to a $.20 decrease or two percent below the baseline rate (refer to Table 4-188). This decrease would reduce the tax paid on a $40,000 home by less than $5.00. The facility-related assessed valuation is so small relative

Table 4-185

Impact on Property Tax Rates in the Fairview School District -- 1979-1990*
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Baseline Expenditure Requirement	$ 3,365	$ 3,315	$ 3,151	$ 3,239
Impact Expenditure Requirement	20	206	217	174
(1) Total Expenditure Requirements	$ 3,385	$ 3,521	$ 3,368	$ 3,413
Baseline Nonproperty Tax Revenues	$ 1,851	$ 1,838	$ 1,836	$ 1,885
Impact Nonproperty Tax Revenues	8	75	115	95
(2) Total Nonproperty Tax Revenues	$ 1,859	$ 1,913	$ 1,951	$ 1,980
Baseline Assessed Valuation	$30,780	$32,025	$35,203	$37,765
Secondary Development-Related Assesed Valuation	168	1,501	1,765	1,437
(3) Total Assessed Valuation	$30,948	$33,526	$36,968	$39,202
(4) Amount to be raised by Property Tax**	$ 1,526	$ 1,608	$ 1,417	$ 1,433
(5) New Property Tax Rate***	$ 49.30	$ 48.00	$ 38.30	$ 36.60
Baseline Property Tax Rate	$ 49.20	$ 46.10	$ 37.40	$ 35.90
Tax Rate Increase (Decrease) as a Percent of Baseline Tax Rate	****	4%	2%	2%

*Property Tax rates are expressed in dollars per thousand of assessed valuation.
**(4) = (1) - (2)
***(5) = (4) ÷ (3)
****Less than 0.5%.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-186

Impact on Property Tax Rates in the Millcreek School District -- 1979-1990*
(Thousands of 1975 Dollars)

	1979	1981	1986	1990
Baseline Expenditure Requirement	$ 11,131	$ 10,626	$ 9,692	$ 8,126
Impact Expenditure Requirement	16	170	133	129
(1) Total Expenditure Requirements	$ 11,147	$ 10,796	$ 9,825	$ 8,255
Baseline Nonproperty Tax Revenues	$ 5,214	$ 5,167	$ 4,836	$ 4,459
Impact Nonproperty Tax Revenues	8	33	77	90
(2) Total Nonproperty Tax Revenues	$ 5,222	$ 5,200	$ 4,913	$ 4,549
Baseline Assessed Valuation	$120,577	$122,207	$125,982	$130,352
Secondary Development-Related Assessed Valuation	156	1,364	1,125	1,088
(3) Total Assessed Valuation	$120,733	$123,561	$127,107	$131,440
(4) Amount to be raised by Property Tax**	$ 5,925	$ 5,596	$ 4,912	$ 3,706
(5) New Property Tax Rate***	$ 49.10	$ 45.30	$ 38.50	$ 28.20
Baseline Property Tax Rate	$ 49.10	$ 44.70	$ 38.60	$ 28.10
Tax Rate Increase (Decrease) as a Percent of Baseline Tax Rate	****	1%	****	****

*Property Tax rates are expressed in dollars per thousand of assessed valuation.
**(4) = (1) - (2)
***(5) = (4) ÷ (3)
****Less than 0.5%.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model.

Table 4-187

Impact on Property Tax Rates in Ashtabula County -- 1979-1990*
(Thousands of 1975 Dollars)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Baseline Expenditure Requirement	$ 4,140	$ 4,159	$ 4,182	$ 4,205	$ 4,228	$ 4,251	$ 4,274	$ 4,294	$ 4,313	$ 4,333	$ 4,353	$ 4,373
Impact Expenditure Requirement	4	55	149	193	193	195	213	261	325	300	299	305
(1) Total Expenditure Requirements	$ 4,144	$ 4,214	$ 4,331	$ 4,398	$ 4,421	$ 4,446	$ 4,487	$ 4,555	$ 4,638	$ 4,633	$ 4,652	$ 4,678
Baseline Nonproperty Tax Revenues	$ 1,954	$ 1,963	$ 1,974	$ 1,985	$ 1,996	$ 2,007	$ 2,018	$ 2,027	$ 2,037	$ 2,047	$ 2,056	$ 2,065
Impact Nonproperty Tax Revenues	20	65	137	167	161	171	211	257	270	273	272	282
(2) Total Nonproperty Tax Revenues	$ 1,974	$ 2,028	$ 2,111	$ 2,152	$ 2,157	$ 2,178	$ 2,229	$ 2,284	$ 2,307	$ 2,320	$ 2,328	$ 2,347
Facility-Related Assessed Valuation	$ 500	$ 500	$ 500	$ 45,800	$126,400	$117,700	$112,600	$107,300	$129,900	$193,000	$183,700	$174,600
Secondary Development Related Assessed Valuation	68	1,203	6,875	16,480	22,639	24,553	26,003	29,607	35,599	41,387	40,971	41,276
Baseline Assessed Valuation	573,150	575,282	577,958	581,134	584,327	587,538	590,767	594,013	596,756	599,511	602,279	605,059
(3) Total Assessed Valuation*	$573,718	$576,985	$585,333	$643,414	$733,366	$729,791	$729,370	$730,920	$762,255	$833,898	$826,950	$820,935
(4) Amount to be Raised by Property Taxes**	$ 2,170	$ 2,186	$ 2,322	$ 2,246	$ 2,264	$ 2,268	$ 2,258	$ 2,274	$ 2,331	$ 2,313	$ 2,324	$ 2,326
(5) Impact Property Tax Rate***	$ 3.80	$ 3.80	$ 3.80	$ 3.50	$ 3.10	$ 3.10	$ 3.10	$ 3.10	$ 3.10	$ 2.80	$ 2.80	$ 2.80
Baseline Property Tax Rate	$ 3.80	$ 3.80	$ 3.80	$ 3.80	$ 3.80	$ 3.80	$ 3.80	$ 3.80	$ 3.80	$ 3.80	$ 3.80	$ 3.80
Tax Rate Increase (Decrease) as a Percent of Baseline Tax Rate	0%	0%	0%	(8%)	(18%)	(18%)	(18%)	(18%)	(18%)	(26%)	(26%)	(26%)

*Valuations are estimated for the year in which the tax would be paid.

**(4) = (1) - (2)

***(5) = (4) ÷ (3). Tax rate in dollars per thousand of assessed valuation.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model; United States Steel Corporation; Arthur D. Little, Inc. Estimates.

Table 4-188

Impact on Property Tax Rates in Erie County -- 1979-1990*
(Thousands of 1975 Dollars)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Baseline Expenditure Requirement	$ 13,482	$ 13,588	$ 13,679	$ 13,771	$ 13,863	$ 13,956	$ 14,050	$ 14,144	$ 14,238	$ 14,334	$ 14,430	$ 14,526
Impact Expenditure Requirement	17	148	310	301	266	291	366	464	478	471	472	487
(1) Total Expenditure Requirements	$ 13,499	$ 13,736	$ 13,989	$ 14,072	$ 14,129	$ 14,247	$ 14,416	$ 14,608	$ 14,716	$ 14,805	$ 14,902	$ 15,013
Baseline Nonproperty Tax Revenues	$ 6,313	$ 6,363	$ 6,406	$ 6,449	$ 6,492	$ 6,535	$ 6,579	$ 6,623	$ 6,667	$ 6,712	$ 6,757	$ 6,802
Impact Nonproperty Tax Revenues	8	49	97	85	74	97	120	99	122	123	126	127
(2) Total Nonproperty Tax Revenues	$ 6,321	$ 6,412	$ 6,503	$ 6,534	$ 6,566	$ 6,632	$ 6,699	$ 6,722	$ 6,789	$ 6,835	$ 6,883	$ 6,929
Facility-Related Assessed Valuation	$ 200	$ 200	$ 9,600	$ 18,200	$ 18,200	$ 18,200	$ 18,200	$ 25,000	$ 25,000	$ 25,000	$ 25,000	$ 25,000
Secondary Development Related Assessed Valuation	676	4,195	7,442	9,024	7,890	8,594	10,692	12,519	13,820	13,642	13,832	13,955
Baseline Assessed Valuation	589,940	594,098	598,090	602,109	606,155	610,228	614,328	618,347	622,573	626,737	630,928	635,148
(3) Total Assessed Valuation*	$590,816	$598,493	$615,132	$629,333	$632,245	$637,022	$643,220	$655,866	$661,393	$665,379	$669,760	$674,103
(4) Amount to be Raised by Property Tax**	$ 7,178	$ 7,324	$ 7,486	$ 7,538	$ 7,563	$ 7,615	$ 7,717	$ 7,886	$ 7,927	$ 7,970	$ 8,019	$ 8,084
(5) Impact Property Tax Rate***	$ 12.10	$ 12.20	$ 12.20	$ 12.00	$ 12.00	$ 12.00	$ 12.00	$ 12.00	$ 12.00	$ 12.00	$ 12.00	$ 12.00
Baseline Property Tax Rate	$ 12.20	$ 12.20	$ 12.20	$ 12.20	$ 12.20	$ 12.20	$ 12.20	$ 12.20	$ 12.20	$ 12.20	$ 12.20	$ 12.20
Tax Rate Increase (Decrease) as a Percent of Baseline Tax Rate	(1%)	0%	0%	(2%)	(2%)	(2%)	(2%)	(2%)	(2%)	(2%)	(2%)	(2%)

*Valuations are estimated for the year in which the tax would be paid.

**(4) = (1) - (2)

***(5) = (4) ÷ (3). Tax rate in dollars per thousand of assessed valuation.

Source: State and Local Tax Structure baseline; Revenue Estimation Working Paper; SIMPACT IV Model; United States Steel Corporation; Arthur D. Little, Inc. estimates.

to the baseline valuation that its addition to the tax base would have little effect on the property tax rate of the county.

Infrastructure

Water Supply

a) Local Study Area

Ohio Local Study Area

4.343
Increased population induced by the proposed activity is expected to have a substantial effect on the water requirements in Conneaut. The annual average and the peak water use attributable to the proposed facility is presented in Table 4-189. The maximum impact occurs in 1987-1990 where the projected increase in water requirements over the estimated baseline water use is about 20 percent. Under baseline conditions, expansion of the Conneaut water supply system would not be required until about 1990. All baseline projections in this section were developed using baseline population projections and water unit requirements from the Water Supply Working Paper. To maintain its baseline capacity of 3.0 mgd in the 1980's, a substantial investment in equipment refurbishing will be required, even without construction of the proposed plant. System and equipment renovation does not include the existing 24-inch Lake Erie water intake which is assumed adequate through 1990. The expansion costs include the cost of upgrading the intake pumps in order to increase the intake flowrate. If the proposed facility is built, expansion of the Conneaut water system will probably be required by about 1982, with approximately 0.4 mgd of capacity expansion occurring at this point in time. By 1987 another 0.3 mgd of system expansion would be needed, raising the total capacity to approximately 3.7 mgd. The estimated cost of the first 0.4 mgd increment of construction to be in place by 1982 is about $285,000 (1975 dollars). The next increment of capacity increase of 0.3 mgd will cost about $214,000 and should be in place by 1987. In addition, a total of about $318,000 for additional water main installation (about 3.2 miles) is expected to be required by 1990 although it is assumed that added mains would be installed between 1982 and 1987. Operating costs for the city of Conneaut Department of Water are also projected to increase and reach an additional $33,000 per year by 1990. The cost of the water supply system expansion and increased operation for Conneaut due to the proposed plant alone are summarized in Table 4-190. The maximum increased total annual cost is $105,000 occurring in 1987. The cost of the additional water, although high (the national average water cost in 1975 was about $0.25 per 1000 gallons delivered), is in all years less than the 1975 baseline water cost for Conneaut of $0.73 per 10

Table 4-189

Water Use Impacts for the Ohio Local Study Area -- 1979-1990

	Peak Water Use (TGD)[1]			Annual Average Water Use (TGD)			
Year	Construction	Operation	Baseline	Construction	Operation	Baseline	% Impact
1979	7	0	2912	5	0	2080	0.2
1980	63	0	2440	45	0	2100	2.1
1981	83	65	2968	60	47	2120	5.0
1982	30	326	2996	22	233	2140	11.9
1983	0	350	3024	0	250	2160	11.6
1984	3	365	3052	2	261	2180	12.1
1985	34	376	3080	24	268	2200	13.3
1986	40	451	3108	28	322	2220	15.8
1987	12	625	3136	9	446	2240	20.3
1988	0	629	3164	0	444	2260	19.9
1989	0	631	3192	0	451	2280	19.8
1990	0	650	3220	0	464	2300	20.2

(1) Thousand gallons per day.

Source: Water Supply baseline; Water Supply Working Paper; SIMPACT IV Model.

Table 4-190

Cost Impacts for Central Water Supply System Expansion and Operation in the Ohio Local Study Area -- 1979-1990

Year	Additional Average Annual Water Supplied (TGD[1])	Additional Annual Interest And Principal (Thousand $)	Additional Annual Operating Cost (Thousand $)	Total Additional Annual Cost (Thousand $)	Cost Per Additional 1000 Gallons ($)
1979	5	-	$ 0.4	$ 0.4	$0.20
1980	45	-	3	3	0.20
1981	107	-	8	8	0.20
1982	255	44	18	62	0.67
1983	250	43	18	61	0.67
1984	263	42	19	61	0.64
1985	292	41	21	62	0.58
1986	350	40	25	65	0.51
1987	455	72	33	105	0.63
1988	449	71	32	103	0.63
1989	451	69	32	101	0.61
1990	464	67	33	100	0.59

(1) Thousand gallons per day.

Source: Water Supply baseline; Water Supply Working Paper; SIMPACT IV Model.

gallons delivered. Since the expected rates for the additional water are in all cases less than the expected baseline rates, the average rate (the weighted average of baseline plus plant-related) is not expected to be higher than the baseline rate itself. Thus, although the absolute costs to the city of Conneaut will increase by as much as $105,000 per year due to plant-related water consumption, these costs will be borne by the increased population and, therefore, the cost per individual user is not expected to increase. Again, those costs are in 1975 dollars and this may be significant under estimates.

Pennsylvania Local Study Area

4.344
The proposed plant would have the greatest water supply impact in the Springfield area. Under existing conditions, residents, commercial, and industrial consumers obtain their water supplies from individual wells whose level of quality and quantity is marginal at best. There is a clear need to develop a central water supply system in Springfield Township and East Springfield Borough for two reasons:

- The expected baseline population increase and the expected population increase due to the proposed plant would result in a population density great enough to justify a central water supply system within the time period of impact analysis (1975-1990). (Such a system would be needed after 2000 to meet baseline population growth alone).

- The poor availability of groundwater of adequate quantity and quality precludes to a large degree the increased development of individual well supplies in many portions of Springfield Township.

4.345
A central water supply system for Springfield Township and East Springfield Borough would obtain its water supply from either groundwater wells or from Lake Erie. However, groundwater aquifiers within Springfield Township are rather limited. Preliminary investigations indicate that there are unconsolidated sediment deposits along the river valley of Crooked Creek in the northeast section of the township and in these areas potential well sites with yields of 15 gpm or more may occur. However, the final strategy of central water supply system development cannot be determined until detailed hydrogeologic investigations are conducted. Therefore, the proposed impacts of both a groundwater-based and a Lake Erie-based water supply system have been analyzed.

4.346
Plant induced population growth during the construction phase is expected to be relatively minor compared to the operation phase. Therefore, the construction activity alone is unlikely to generate the need for a central water supply system in the Springfield area. The time-phase increased water requirements on the basis of peak and annual average use are shown in Table 4-191. Construction-related water use reaches a peak of 20,000 gpd during 1981. After 1981, construction-related water use drops eventually reaching zero by 1988. Operations-related water use grows rapidly after 1981. Peak operations-related water use is about 180,000 gpd in 1982 and reaches 370,000 gpd by 1990. Corresponding baseline peak water use ranges from about 640,000 gpd to 800,000 gpd over the 1979-1990 analysis period. The percentage increase over baseline use is about 46 percent by 1990. By 1982, the impact will be 27 percent of average baseline demand. Studies conducted by the Erie County Planning Commission indicate that the water supply system needs for Springfield Township and East Springfield Borough could be met by the establishment of a joint water authority. Based on the water requirements projected in Table 4-191 the applicant estimates that the authority should be established by 1982 and that a central water supply system with a 1990 capacity of about 1.0 mgd should be considered in anticipation of future development.

4.347
Although the groundwater-supply system is the least expensive approach, it may be necessary to develop a Lake Erie-supplied system if no adequate well sites can be located. Both types of water supply system are cost-estimated in order to gauge the residential cost impact in either case. A 1.0 mgd groundwater central supply system including treatment equipment would cost an estimated $490,000 (1975 dollars). Installation cost of new water distribution pipelines in the system would be about $170,000 (1.7 miles) by 1982, and would exceed $320,000 (3.2 miles) by 1990. In addition, an estimated 5.0 miles or $490,000 worth of pipeline along existing streets and roads would be required to service Springfield Township and East Springfield Borough. New water supply system investment by 1982 would total about $1.15 million. The total estimated costs of operation based on a 25-year bond at 5-1/2 percent interest are presented in Table 4-192. The development of a Lake Erie central water supply system would be considerably more expensive for Springfield Township and East Springfield Borough. An offshore water intake pipeline designed to satisfy minimum water demand for the future 40-50 years would have to be installed. (4-3) A 20-inch pipeline of 5,000 feet in length would cost about $550,000 (1975 dollars) and would be able to supply at least two-three mgd. Total costs associated with the construction of the intake and central water supply system utilizing Lake Erie as a source of supply intake would cost about $927,000.

Table 4-191

Water Use Impacts in the Pennsylvania Local Study Area -- 1979-1990

Year	Peak Water Use (TGD)[1]			Annual Average Use (TGD)			
	Construction	Operation	Baseline	Construction	Operation	Baseline	% Impact
1979	0	0	640	0	0	400	0.1%
1980	18	0	655	11	0	409	2.7
1981	20	35	670	12	22	418	8.1
1982	10	177	684	6	110	427	27.3
1983	0	200	698	0	125	436	29.3
1984	0	215	713	0	135	445	30.2
1985	8	229	727	5	143	455	32.5
1986	8	281	742	5	176	464	39.0
1987	4	358	756	2	224	473	47.9
1988	0	362	771	0	226	482	46.9
1989	0	362	785	0	226	491	46.1
1990	0	370	800	0	231	500	46.2

(1) Thousand gallons per day.

Source: Water Supply baseline; Water Supply Working Paper; SIMPACT IV Model.

Table 4-192

Cost Impact of Central Water Supply System Construction and Operation in the Pennsylvania Local Study Area (Groundwater-Supplied System) -- 1979-1990

Year	Average Annual Water Supplied (TGD)[1]	Annual Interest and Principal (Thousand $)	Annual Operating Cost (Thousand $)	Total Annual Cost (Thousand $)	Cost Per 1000 gallons ($)
1979	-	-	-	-	-
1980	-	-	-	-	-
1981	-	-	-	-	-
1982	400	$109	$38	$147	$1.00
1983	425	107	40	147	0.95
1984	440	104	42	146	0.91
1985	450	102	43	145	0.88
1986	500	115	48	163	0.89
1987	550	112	52	164	0.82
1988	550	109	52	161	0.80
1989	560	106	53	159	0.78
1990	570	103	54	157	0.75

(1) Thousand gallons per day; water use included all impact water use plus two-thirds at baseline water use.

Source: Water Supply baseline; Water Supply Working Paper; SIMPACT 1V Model.

The same water main distribution costs would be required as for the groundwater-supplied system. The cost impacts of a Lake Erie central water system for Springfield Township and East Springfield Borough are shown in Table 4-193. As shown in Tables 4-193 and 4-194, the average cost per 1,000 gallons is high for either supply source. By comparison, in 1975 the Bureau of Water in Erie reported a cost of water of $0.28 per 1,000 gallons delivered. In Conneaut City, 1975, the estimated cost was $0.73 per 1,000 gallons delivered. The water rates that would be charged to domestic users in Springfield would probably be significantly higher than the rates the surrounding communities now charge.

b) Ohio and Pennsylvania Principal Study Area

4.348
Plant-induced annual average water requirements as a percentage of baseline annual average requirements are expected to peak at 25 percent for Fairview Township during the construction year of 1981 while in Kingsville the peak will be 24 percent attained in 1980. However, the near-term impact levels and percentages may be somewhat overstated because the construction-related population (especially weeklies) will probably use less than the average per capita estimated water use. The increased amount of annual average water required to meet the needs of the population induced by the proposed plant is shown in Table 4-194. The impact relative to baseline water use ranges from small (less than one percent in the Pennsylvania Principal Study Area which is noncoastal) to large (22 percent and 23 percent, respectively, for Fairview in 1981 and Kingsville in 1986, respectively). Estimated peak water requirements are shown in Table 4-195. For the most part the capacity of the existing water supply systems is adequate to handle the increased requirements shown in Table 4-195. However, increased demand will generate additional storage and pumping capacity requirements within the distribution systems, along with the need for water main pipeline expansion. In both the Ohio and Pennsylvania Principal Study Areas, the installation of new water mains should proceed concurrently with the construction of new streets. Plant-induced water main additions for the Principal Study Area are summarized in Table 4-196.

4.349
Additional costs of storage/pumping capacity and water mains installation in each of the Principal Study Areas outside of Conneaut and Springfield are presented in Table 4-197. The capacity increments were chosen so that adequate central supply and distribution equipment would be available to supply both operation-related and construction-related requirements. In cases of peak construction-related requirements occurring during 1974-1984, the maximum peak use

Table 4-193

Cost Impact of Central Water Supply System Construction and Operation in the Pennsylvania Local Study Area (Lake Erie-Supplied Water System) -- 1979-1990

Year	Average Annual Water Supplied (TGD)[1]	Annual Interest and Principal (Thousand $)	Annual Operating Cost (Thousand $)	Total Annual Cost (Thousand $)	Cost Per 1000 gallons ($)
1979	-	-	-	-	-
1980	-	-	-	-	-
1981	-	-	-	-	-
1982	400	$ 151	$ 29	$ 180	$ 1.23
1983	425	147	31	178	1.15
1984	440	144	32	176	1.10
1985	450	140	32	172	1.05
1986	500	137	36	173	.95
1987	550	149	40	189	.94
1988	550	146	40	186	.93
1989	560	142	40	182	.89
1990	570	138	41	179	.86

(1) Thousand gallons per day; water use includes all impact water use plus two-thirds of baseline water use.

Source: Water Supply baseline; Water Supply Working Paper; SIMPACT IV Model.

Table 4-194

Water Supply Requirements in the Principal Study Area (Average Annual Water Use)

	Baseline Annual Average Water Use (TGD)(1)			Construction-Related (TGD)			Operations-Related (TGD)			Total Impact (TGD)(2)			% Impact		
	1981	1986	1990	1981	1986	1990	1981	1986	1990	1981	1986	1990	1981	1986	1990
Pennsylvania Principal Study Area															
Girard	516	500	600	22	10	0	18	74	99	39	84	99	8%	17%	17%
Fairview	210	260	300	32	16	0	15	35	40	47	51	40	22	20	13
Millcreek	910	960	1000	83	43	0	9	28	50	92	71	50	10	7	5
Rest of Principal Study Area	47500	49200	50500	129	70	0	27	91	153	156	161	153	0.3	0.3	0.3
Ohio Principal Study Area															
Kingsville	410	460	500	43	21	0	32	86	108	75	107	108	18	23	22
Ashtabula Township	1010	1060	1100	22	11	0	24	116	152	46	126	152	5	12	14
Ashtabula City	3530	3680	3800	35	19	0	6	45	68	42	65	68	1	2	2
Saybrook	710	760	800	19	9	0	16	20	20	34	29	20	5	4	3
Rest of Principal Study Area	710	760	800	45	23	0	17	57	69	62	80	69	9	11	9

(1) Thousand gallons per day.

(2) Total may not match due to rounding.

Source: Water Supply baseline; Water Supply Working Paper; SIMPACT IV Model.

Table 4-195

Water Supply Requirements (Peak Water Use) In the Principal Study Area
(Thousand Gallons per Day)

	Construction-Related			Operations-Related			Total Impact		
	1981	1986	1980	1981	1986	1990	1981	1986	1990
Pennsylvania Principal Study Area									
Girard	33	15	0	27	112	150	60	127	150
Fairview	48	24	0	2[illegible]	53	60	71	76	60
Millcreek	115	60	0	1[illegible]	38	69	127	98	69
Rest of Principal Study Area	194	105	0	40	136	230	234	241	230
Ohio Principal Study Area									
Kingsville	66	32	0	50	133	167	115	16[illegible]	[illegible]
Ashtabula Township	34	17	0	37	[illegible]78	234	71	194	234
Ashtabula City	54	30	0	10	[illegible]0	105	64	10[illegible]	105
Saybrook	30	1[illegible]	0	24	31	31	53	4[illegible]	31
Rest of Principal Study Area	67	3[illegible]	0	26	[illegible]6	104	93	12[illegible]	104

Source: Water Supply baseline; Water Supply Working Paper; SIMPACT IV Model.

Table 4-198

Induced Watermain Pipeline Additions in the Principal Study Area -- 1979-1990

	Impact Pipeline Additions (miles)			Pipeline Additions as a Percent of 1975 Baseline Watermain Pipeline Additions		
	1979-1981	1982-1986	1987-1990	1979-1981	1982-1986	1987-1990
Pennsylvania Principal Study Area						
Girard Area	0.9	0.6	0.0	2.6%	1.7%	0.0%
Fairview	1.1	0.0	0.0	7.3	0.0	0.0
Millcreek	0.6	0.0	0.0	1.7	0.0	0.0
Rest of Principal Study Area	1.4	0.0	0.0	0.3	0.0	0.0
Ohio Principal Study Area						
Kingsville	1.6	0.7	0.0			
Ashtabula Township	1.2	0.5	0.4	(1.6	0.7	0.2)
				Ashtabula Water Works Co.		
Ashtabula City	0.0	0.0	0.0			
Saybrook	0.7	0.1	0.0	(1.5	0.3	0.0)
Rest of Principal Study Area	1.0	0.2	0.0	Ohio Water Service		

Source: Water Supply baseline; Water Supply Working Paper; SIMPACT IV Model.

Table 4-197

Induced Water Supply System Cost Impacts in the Principal Study Area Due to the Proposed Project -- 1979-1990

	Additional Storage/Pump Investments (Thousand $)			Additional Watermain Investments (Thousand $)			Additional Operating Costs (Thousand $/Year)		
	1979-1981	1982-1986	1987-1990	1979-1981	1982-1986	1987-1990	1981	1986	1990
Pennsylvania Principal Study Area									
Girard	$ 15	$15	$ 0	$ 85	$ 60	$ 0	$ 4	$ 8	$ 9
Fairview	18	0	0	110	0	0	4	4	3
Millcreek	26	0	0	63	0	0	7	6	4
Rest of Principal Study Area	41	21	0	143	0	0	13	13	13
Ohio Principal Study Area									
Kingsville	31	10	0	151	66	0	5	8	8
Ashtabula Township	18	31	10	117	48	36	3	9	11
Ashtabula City	15	10	0	0	0	0	3	5	5
Saybrook	10	0	0	72	7	0	2	2	1
Rest of Principal Study Area	23	5	0	111	23	0	6	5	7

Source: Water Supply baseline; Water Supply Working Paper; SIMPACT IV Model.

was satisfied by equipment construction to the extent the requirements occurred consequentially for two or more years. In Table 4-198 the costs are converted into debt service coinciding for the target years 1981, 1986, and 1990. These are added to the additional operating costs from Table 4-197 to determine total additional costs in Table 4-198. For the rest of the Ohio Study Area, a 7.5 percent interest rate was used for the private suppliers who supply the rest of Ohio's water supply (e.g. Ashtabula Water Works Co. and the Ohio Water Service Co.). The marginal cost of the additional water is calculated by comparing total additional costs to the amount of additional water delivered. In cases where the marginal costs are higher, an across-the-board increase in water rates is indicated by a weighing of the average and marginal water costs. Table 4-199 shows the estimated average and marginal costs of water for the central water supply systems in the Principal Study Area. Water rate increases will undoubtedly occur as water supply construction and operation costs rise.

Sanitary Wastewater Collection and Treatment

a) Projected Impact Conditions

4.350
All cost estimates in this section are in 1975 dollars and do not reflect the influence of inflation. Therefore, costs in later years may be significantly higher.

Local Study Area

Conneaut

4.351
Development induced by the proposed plant is projected to increase the sewered population of Conneaut by approximately 4,750 persons in 1990. Table 4-200 provides a comparison of projected baseline and impact sewage facility requirements for the city of Conneaut. Assuming that the average flow rate remains at 182 gallons per capita per day, a 0.7 mgd expansion of the existing treatment plant would be required at an estimated cost of approximately $1.1 million. It is possible that Conneaut could service the plant-related population with the existing treatment plant if infiltration - inflow is reduced by upgrading the existing collection system. Although no new interceptors are expected to be required to serve the new population induced by the proposed plant, construction of laterals and extensions of some interceptors is estimated to cost $600,000. Approximately 35 man-years of construction labor would be required for the projected expansion of the treatment plant and construction of sewers. Annual operating costs are estimated to increase by

Table 4-198

Additional Annual Water Supply System Costs in the Principal Study Area Due to the Proposed Project

	Additional Principal And Interest Costs (Thousand $)			Total Additional Costs (Thousand $)			Cost of Additional Water Per 1000 Gallons ($)		
	1981	1986	1990	1981	1986	1990	1981	1986	1990
Pennsylvania Principal Study Area									
Girard	$ 10	$ 16	$ 14	$ 14	$ 24	$ 23	$0.98	$ 0.78	$0.64
Fairview	12	11	10	16	15	13	0.93	0.81	0.89
Millcreek	9	8	7	16	14	11	0.48	0.54	0.60
Rest of Principal Study Area	17	17	15	30	30	28	0.53	0.51	0.50
Ohio Principal Study Area									
Kingsville	21	27	19	26	35	27	0.95	0.90	0.68
Ashtabula Township	15	23	23	18	32	34	1.07	0.70	0.61
Ashtabula City	2	3	2	5	8	7	0.33	0.34	0.28
Saybrook	9	9	8	11	11	9	0.89	1.04	1.23
Rest of Principal Study Area	12	13	12	18	18	19	0.80	0.62	0.75

Source: Water Supply baseline; Water Supply Working Paper; SIMPACT IV Model.

Table 4-199

Comparison of Water Supply System Additions Marginal Cost to 1975 Average Costs for the Principal Study Area Water Supply Systems (1975 Dollars)

Pennsylvania Principal Study Area	1975 Average Cost ($/1000 Gallons)	Estimated Marginal Costs of Additional Water ($/1000 Gallons)			Estimated Increase in 1975 Baseline Water Rate Due to Additional Water Requirement (%)[1]		
		1981	1986	1990	1981	1986	1990
Girard/Lake City Water Departments	$ 0.57	$0.98	$0.78	$0.64	5%	5%	2%
Fairview Borough Water Authority	0.84	0.93	0.81	0.89	2	0	1
Pennsylvania Water Co. Erie Suburban Division	0.91	0.48	0.54	0.60	0	0	0
City of Erie	0.28	0.53	0.51	0.50	<1	<1	<1
Ohio Principal Study Area							
Conneaut Water Department	0.73	0.20	0.51	0.59	0	0	0
Ashtabula Water Works Co.	1.09	0.82	0.69	0.57	0	0	0
Ohio Water Service Co.	1.00	0.84[2]	1.04[2]	1.23[2]	0	0	0

(1) Construction and operation inflation would increase those percentages relative to 1975 constant dollars.
(2) Saybrook Township only.

Source: Water Supply baseline; Water Supply Working Paper; SIMPACT IV Model.

Table 4-200

Existing Facilities and Projected Sewage Facility Requirements in the City of Conneaut -- 1975-1990

	Existing 1975	Incremental Baseline Growth to 1990	Incremental Impact Growth to 1990	Total 1990
Sewered Population	11,000	4,000	4,750	19,750
Average Sewage Flow Rate (MGD)	2.00	0.75	0.85	3.60
Design Flow Rate of Treatment Plant (MGD)	2.92	0.0	0.70	3.62
Construction Cost of Treatment Plant (000$)	N/A	0	1,100	1,100
Construction Cost of Interceptors (000$)	N/A	4,950	600	5,550
Construction Labor Required (Man-years)	N/A	100	35	135
Annual Operating Costs (000$ per year)	200	80	90	370
Operating Labor Required (Persons)	10	3	4	17

N/A = Not Applicable.

Source: Sanitary Wastewater Collection and Treatment baseline and Working Paper; SIMPACT IV Model.

$90,000 per year and four additional employees would be required to service the new population. Conneaut City expects to begin construction of the initial portion of the east side interceptor in 1977. Expansions of service through the east side and into areas south and west of the existing system are projected to occur throughout the 1980's. However, no firm dates have been set for this expansion. To provide sewage facilities on a timely basis in Conneaut City, expansions of interceptors would need to be underway in 1979 to service construction-related new population increases expected in 1980. If, as projected, operation-related new population begins to increase in 1981 and reaches 2,500 persons in 1982, additional expansions of interceptors would be required at that time. If Conneaut is to receive Federal funding for such interceptor construction, facility plans would need to be completed quickly and funding approved expeditiously to meet the projected needs in time. If sewers are not available for the new population, it is likely that developers would seek to install septic tanks or packaged treatment plants to service new homes.

Springfield Township and East Springfield Borough

4.352
Under baseline conditions, it is expected that no sewage service will be provided by Springfield. Induced development caused by the proposed plant is estimated to increase the population of Springfield by 2,800 persons by the year 1990 although it is unlikely that such an increase in population would occur without sewer service. Much of the soil in the Springfield area is not suitable for septic tanks. The lack of sewage infrastructure could be offset by private developments which would provide packaged treatment plants to service new homes. However, if local authorities anticipate the need and incorporate infrastructure sewage needs into comprehensive community plans, it is possible that facilities construction could begin in the early 1980's. The need for sewage facilities is projected to become pressing by 1982 when it is estimated that population will increase by 1,400 persons. At this time, the status of sewer facilities planning in Springfield is very uncertain. Without the proposed plant, sewer facilities would probably not be needed. If sewer facilities are to be constructed, at least two options are available to Springfield:

- Springfield Township and/or East Springfield Borough may decide to construct a sewer system and sewage treatment plant.

- Springfield Township and/or East Springfield Borough may decide to tie into the proposed Northwest Erie County Sewer Authority.

The relative merits of the two options are not examined here. For puposes of analysis, it is assumed that if Springfield decides to provide sewer service, it would tie into the proposed Northwest Erie County Sewer Authority. Therefore, only the impact of the proposed plant on the Northwest Erie County Sewer Authority including Springfield Township and East Springfield Borough are considered in this section.

Principal Study Area

Northwest Erie County Sewer Authority Area

4.353
Development induced by the lakefront plant is projected to increase the sewered population in the Northwest Erie County Sewer Authority service area by approximately 6,100 (including 4,760 in the Springfield area). A comparison of baseline requirements and plant-related impact requirements for the Northwest Erie County Sewer Authority service area are presented in Table 4-201. The additional population would generate increased sewage flows of approximately 0.8 mgd. Assuming a "worst case", i.e., that the Northwest Erie County Sewer Authority rates the treatment plant to service a design population excluding new population induced by the proposed steel plant, then an expansion of the proposed treatment plant would be required. The cost of the treatment plant expansion is estimated to be $2.35 million, and the estimated cost of the additional interceptors required to service the new population is approximately $4.75 million. Approximately 140 man-years of construction labor would be required for the expansions of the treatment plant and interceptors. Annual operating costs are projected to increase by $115,000, and five additional employees would be required. Most of the additional sewered population projected for the area occurs in Springfield Township and East Springfield Borough (4,760 out of 6,100 persons). Of the new sewered population in Springfield Township and East Springfield Borough, approximately 1,960 (41 percent) would be induced by the proposed plant, and 2,800 persons are residents expected in 1990 under baseline conditions. The need for additional sewage service will appear in 1982 and would be more critically felt in Springfield Township and East Springfield Borough where a proposed plant-induced population increase of approximately 1,400 persons is expected by 1982. As noted previously, Springfield Township and East Springfield Borough currently have no plans to provide sewer service. Approvals of facility plans and funding of projects could occur by 1980 and 1981 if decisions are made expeditiously. If sewer service is unavailable, it is likely that packaged treatment plants would be built to serve new developments.

Table 4-201

Existing Facilities and Projected Sewage Facility Requirements in the Northwest Erie County Sewer Authority Service Area -- 1975-1990(1)

	Existing 1975(2)	Incremental Baseline Growth to 1990	Incremental Impact Growth to 1990	Total 1990
Sewered Population	4,800	11,200	6,100	22,100
Average Sewage Flow Rate (MGD)	0.8	1.5	0.8	3.0
Design Flow Rate of Treatment Plant (MGD)	0.76	2.2	0.8	3.0
Construction Cost of Treatment Plant (000$)	N/A	7,900	2,350	10,250
Construction Cost of Interceptors (000$)	N/A	11,100	4,750	15,850
Construction Labor Required (Man-years)	N/A	380	140	520
Annual Operating Costs (000$ per Year)	90	210	115	415
Operating Labor Required (Persons)	4	9	5	18

N/A - Not Applicable.

(1) Springfield Township and East Springfield Borough are assumed to join the Sewer Authority under the impact case, but not in the baseline case.

(2) Lake City and Girard Borough currently operate their own treatment plants and interceptor collection networks. The existing sewage treatment plants are planned to be replaced by a centralized treatment plant.

Source: Sanitary Wastewater Collection and Treatment baseline and Working Paper; SIMPACT IV Model.

Ashtabula City Service Area

4.354
Development induced by the proposed plant is estimated to increase the sewered population in the area serviced by the Ashtabula City treatment plant by 3,900. The existing treatment plant has sufficient capacity to meet requirements of both baseline and plant-induced population increases. Only minor additions to existing and planned interceptors are projected to be required to service population induced by proposed plant development. The impact analysis for the Ashtabula City area assumes that extensive expansion of the existing interceptor network will occur under baseline conditions before 1990. Operating costs are estimated to increase by $100,000 per year and five additional employees will probably be needed. A comparison of baseline facilities and projected impact requirements for the Ashtabula City service area is presented in Table 4-202. Ashtabula City received funding for a facilities plan from the EPA in June 1977. The plan is either nearing completion or complete at this time. Construction of interceptors is expected to begin in 1980, with most extensions being completed by 1985. Kingsville and North Kingsville Village are estimated to have a plant-induced population increase of approximately 1,000 persons by 1981 (roughly 50 percent construction-related and 50 percent operations-related). North Kingsville is ranked 357th on the Ohio EPA's Municipal Project Priority list and will probably carry out its own facilities planning. Although North Kingsville has relatively sandy soil which allows good septic tank operation, some developments may employ packaged treatment plants if sewer service is not available. Population increases that would occur in other areas of Ashtabula County due to plant-induced development are projected to be relatively small. Therefore, with the possible exception of North Kingsville Village, the schedule of interceptor expansions planned under the baseline case is projected to be adequate to manage the sewer needs of plant-induced population.

Erie City Service Area

4.355
Development induced by the proposed plant is projected to increase the sewered population of the area serviced by the Erie City treatment plant by 1,000 persons. Small expansions of the planned interceptor network and the treatment plant, with an estimated construction cost of $350,000 are projected. Annual operating costs are projected to increase by approximately $20,000, with one additional employee required. A comparison of projected baseline and plant-related impact requirements for sewage facilities in the Erie City service is presented in Table 4-203.

Table 4-202

Existing Facilities and Projected Sewage Facility Requirements in the Ashtabula City Service Area -- 1975-1990

	Existing 1975	Incremental Baseline Growth to 1990	Incremental Impact Growth to 1990	Total 1990
Sewered Population	25,000	23,000	3,900	51,900
Average Sewage Flow Rate (MGD)	4.0	3.7	0.6	8.3
Design Flow Rate of Treatment Plant (MGD)	12.0	0.0	0.0	12.0
Construction Cost of Treatment Plant (000$)	N/A	0	0	0.0
Construction Cost of Interceptors (000$)	N/A	19,150	150	19,300
Construction Labor Required (Man-years)	N/A	383	3	386
Annual Operating Costs (000$ per Year)	600	550	100	1,250
Operating Labor Required (Persons)	22	20	4	46

N/A = Not Applicable.

Source: Sanitary Wastewater Collection and Treatment baseline and Working Paper; SIMPACT IV Model.

Table 4-203

Existing Facilities and Projected Sewage Facility Requirements in the Erie City Service Area -- 1975-1990

	Existing 1975	Incremental Baseline Growth to 1990	Incremental Impact Growth to 1990	Total 1990
Sewered Population	175,000	32,000	1,000	208,000
Average Sewage Flow Rate (MGD)	55.0	25.5 (1)	0.5	81.0
Design Flow Rate of Treatment Plant (MGD)	65.0	15.5	0.5	81.0
Construction Cost of Treatment Plant (000$)	N/A	17,150	300	17,450
Construction Cost of Interceptors (000$)	N/A	26,650	50	26,700
Construction Labor Required (Man-years)	N/A	876	7	883
Annual Operating Costs (000$ per Year)	3,935	720	20	4,675
Operating Labor Required (Persons)	105	19	1	125

N/A = Not Applicable.

1. The large baseline increase in the average sewage flow rate (25.5 MGD) is based on the assumption that some existing industrial treatment plants will utilize an additional 13.0 MGD of the Erie City treatment plant by 1990.

Source: Sanitary Wastewater Collection and Treatment baseline and Working Paper; SIMPACT IV Model.

The Remainder of the Regional Study Area

4.356
Since population is projected to increase by less than 1,000 persons for remaining portions of the Regional Study Area, the applicant's consultant projects that sewage facility development induced by the lakefront plant in these areas would be minimal. Therefore, increments in flow and/or costs to individual systems that would accompany this element of the projected growth are not discussed in detail.

Pollutant Loadings

4.357
Two parameters used to measure the effectiveness of sewage treatment are biochemical oxygen demand (BOD) and phosphorus concentrations in effluent from sewage treatment plants. Assuming that existing removal standards are maintained in the future, loadings of these constituents may be projected based on the sewage flow rate estimates discussed earlier. Other parameters (chemical oxygen demand, total dissolved solids, heavy metals, ammonia, etc.) are important, but data on these are not currently available. The BOD and phosphorus concentrations of effluents of the four major treatment plants serving the coastal communities are shown in Table 4-204. Conneaut City data are actual results for June and July, 1977. Data for other treatment plants are standards required to be achieved in 1977. It is assumed that the proposed Northwest Erie County Sewer Authority treatment plant will have a standard identical to the Erie City treatment plant. Table 4-205 provides an estimate of BOD and phosphorous loadings using the effluent data presented in Table 4-204. Estimates are provided for the year 1975, baseline conditions in 1990, and impact conditions in 1990. The Conneaut Plant discharges near the mouth of Conneaut Creek, while the other three plants are expected to discharge directly to Lake Erie. The plant-induced development is projected to increase BOD and phosphorus loadings from the four treatment plants above 1990 baseline values by the following amounts:

	BOD		Phosphorous	
	Pound/day	Percent	Pound/Day	Percent
Conneaut City	53	33.8	12	33.3
Northwest Erie	175	30.4	6	31.6
Ashtabula City	117	9.2	6	9.5
Erie City	125	0.6	5	0.7

Table 4-204

Selected Effluent Characteristics of Treatment Plants
(Milligrams per Liter)

	BOD	Phosphorous
Conneaut City(1)	7	1.6
Northwest Erie County(2)	30	1.0
Ashtabula City(2)	20	1.0
Erie City(2)	30	1.0

(1) Data for Conneaut City represent averages for June and July, 1977.

(2) Data for other treatment plants are standards. The Northwest Erie County treatment plant does not exist, so it has been assumed that the standard will be identical to the Erie City standard. The U.S. E.P.A. has indicated that the 1.0 mg/l phosphorus concentration for effluent in Erie, PA has not been met in the last several years. U.S. E.P.A. also believes that a 0.5 mg/l concentration is not an unrealistic limit that should be imposed along with an appropriate load allocation.

Source: Field interviews with sewer agencies.

Table 4-205

Selected Contaminant Loadings From Major Treatment Plants

	Sewage Flow Rate (MGD)			BOD (Lbs/Day)[1]			Phosphorus (Lbs/Day)[1]		
	1975	Baseline 1990	Impact 1990	1975	Baseline 1990	Impact 1990	1975	Baseline 1990	Impact 1990
Conneaut City	2.0	2.7	3.6	117	157	210	27	36	48
Northwest Erie	0.8	2.3	3.0	239[2]	575	750	31[2]	19	25
Ashtabula City	4.0	7.6	8.3	666	1,266	1,383	33	63	69
Erie City	55.0	80.5	81.0	13,744	20,117	20,242	458	670	675
Totals	61.8	93.1	95.9	14,766	22,115	22,585	549	788	817

(1) 1 milligram per liter (mg/l) = 8.33 pounds per million gallons.

(2) The 1975 Northwest Erie figures represent the Lake City plant and the Girard plant. In 1973, the effluent characteristics for these plants were:

	Flow Rate (MGD)	BOD (mg/l)	Phosphorus (mg/l)
Girard	0.34	25	8.56
Lake City	0.42	48	2.12

Source: Pennsylvania Department of Environmental Resources, Draft COWAMP, 1976 and Arthur D. Little, Inc. estimates based on interviews with local officials.

Principal Repayment and Interest Costs Assuming No Federal Funding For Interceptors

4.358
In recent years, the EPA has not generally approved funding for construction of new interceptors. Funding for 75 percent of the construction cost of sewage treatment plants has continued to be available. Should there be no outside source of funding for interceptors, it is possible that sewer authorities will, as in the era prior to Federal funding, issue some form of debt to finance the local portion of facilities costs. Payment of principal and interest would be likely funded by increases in sewer charges to user. The average annual principal repayment, interest cost and the total annual payment for the construction of interceptors and sewage treatment plants for Conneaut, the Ashtabula City area, the Northwest Erie area and the Erie City area are shown in Tables 4-206 and 4-207. Data are reported on a per capita basis for the baseline case and impact case, respectively, assuming no Federal funding of interceptors. Assuming that the Federal grants are available for 75 percent of the total construction cost of sewage treatment plants and that the local community will finance the 25 percent of the cost of sewage treatment plants and 100 percent of the cost of interceptors (via a form of debt requiring equal annual payments over 25 years at an interest rate of 5.5 percent) the total annual payment and can be computed and divided into principal and interest components. Although Pennsylvania provides an annual grant to sewer agencies equal to two percent of the sewage treatment plant construction cost, this grant is not included in the estimates of annual payments shown on the tables. For the Erie City area this grant would amount to $10.72 per capital per year and for the Northwest Erie area, $11.44 per capita per year. It was also assumed that sewage charges would be maintained at current levels for homes presently served and that the incremental construction cost burden would fall on newly sewered homes.

Estimated Residential Sewer Bill Assuming No Federal Funding for Interceptors

4.359
Estimated residential sewer bills for newly sewered homes in various localities are shown in Tables 4-208 and 4-209 for the baseline case and plant-related impact situation respectively, assuming no Federal funding of interceptors. The estimated bill includes the operating and maintenance costs shown in previous tables and annualized construction cost payments shown in Tables 4-206 and 4-207. Assuming that the industrial share of total annual costs is proportional to the industrial portion of total sewage flow (which is variable among community practices) the annual residential sewer bill was computed

Table 4-206

Principal Repayment and Interest Costs for New Sewage Facilities
"*Locally Funded*" *Baseline Case*
(1975 Dollars Per Capita)

Service Area	Total Cost of Construction	Total to be Financed[1] by Localities	Average Annual Principal Repayment	Average Annual Interest Cost	Total Annual Payment
Conneaut	$1,241.00	$1,241.00	$49.64	$42.88	$ 92.52
Ashtabula City Area	833.00	833.00	33.32	28.78	62.10
Northwest Erie Area[2]	1,700.00	1,700.00	68.00	58.73	126.73
Springfield Area	0.00	0.00	0.00	0.00	0.00
Erie City Area[2]	1,369.00	1,369.00	54.76	47.30	102.66

(1) Assumes localities finance 100% of the sewage treatment plant and 100% of the construction cost of interceptors with a form of debt at an interest rate of 5.5% and equal annual payments over 25 years.

(2) Pennsylvania provides grants covering 2% of sewage treatment plant construction costs. However, the grants have not been included in this estimate.

Source: Arthur D. Little, Inc., estimates.

Table 4-207

Principal Repayment and Interest Costs for New Sewage Facilities
"Locally Funded" Impact Case
(1975 Dollars Per Capita)

Service Area	Total Cost of Construction	Total to be Financed[1] by Localitities	Average Annual Principal Repayment	Average Annual Interest Cost	Total Annual Payment
Conneaut	$ 359.00	$ 187.25	$ 7.49	$ 6.47	$13.96
Ashtabula City Area	38.00	38.00	1.52	1.31	2.83
Northwest Erie Area	434.00	143.75[3]	5.75	4.97	10.72
Springfield Area[2]	1,379.00	1,088.75[3]	43.55	37.62	81.17
Erie City Area	353.00	166.75[3]	4.67	4.03	8.70

(1) Assumes localities finance 25% of the sewage treatment plant and all of the construction cost of interceptors with a form of debt at an interest rate of 5.5% and equal annual payments over 25 years.

(2) While the Springfield area may become part of the Northwest Erie system, sewer development in Springfield is assumed to occur only in the impact case.

(3) Pennsylvania provides localities with grants covering 2% of sewage treatment plant construction costs. However, the grants have not been included in this estimate.

Source: Arthur D. Little, Inc. estimates.

Table 4-208

Estimated Residential Sewer Bill "Locally Funded" Baseline Case
(1975 Dollars)

Service Area	Annual Operating and Maintenance Cost ($ Per Capita)	Annual Construction Cost Payment ($ Per Capita)	Total Annual Cost ($ Per Capita)	Industrial Share of Cost[1] (%)	Annual Residential Sewer Bill ($ Per Capita)	Monthly Residential Sewer Bill[2] ($/Household)
Conneaut	$18.70	$ 92.52	$111,22	34%	$ 73.41	$21.41
Ashtabula City Area	24.06	62.10	86.16	10	77.54	22.62
Northwest Erie Area	18.70	126.73	145.43	0	145.43	42.41
Springfield Area	0.00	0.00	0.00	0	0.00	0.00
Erie City Area	22.48	102.06	124.54	40	74.72	21.79

(1) The industrial share of total sewage costs is assumed to be proportional to the industrial portion of total sewage flow. This will vary in practice.

(2) Assumes 3.5 persons per household.

Source: Arthur D. Little, Inc., estimates.

Table 4-209

Estimated Residential Sewer Bill - "Locally Funded" Impact Case
(1975 Dollars)

Service Area	Annual Operating and Maintenance Cost ($ Per Capital)	Annual Construction Cost Payment ($ Per Capita)	Total Annual Cost ($ Per Capita)	Industrial Share of Cost(1) (%)	Annual Residential Sewer Bill ($ Per Capita)	Monthly Residential Sewer Bill(2) ($/Household)
Conneaut	$18.70	$ 26.76	$ 45.46	34	$ 30.00	$ 8.75
Ashtabula Area	24.06	2.83	26.89	10	24.20	7.06
Northwest Erie Area	18.70	32.35	51.05	0	51.05	14.89
Springfield Area	18.70	102.80	121.50	0	121.50	35.44
Erie City Area	22.48	26.32	48.80	40	29.28	8.54

(1) The industrial share of total sewage costs is assumed to be proportional to the industrial portion of total sewage flow.

(2) Assumes 3.5 persons per household.

Source: Arthur D. Little, Inc., estimates.

by deducting the industrial share of costs from total costs. Based on an average household size of 3.5 persons and assuming that the sewer authority adjusts sewer bills to a level that just covers costs, the monthly sewer bill per household was estimated. If newly sewered homes are fully assessed for all construction-related payments as well as their portion of operating and maintenance costs, then the monthly sewer bill would be $16 to $31 per household in the baseline case. This figure is significantly higher than existing charges of $5 to $15 per household per month. Since few new interceptors are required under impact related conditions the monthly sewer bill for newly sewered homes attributed to growth induced by the lakefront plant would be $5 to $30 per household. New sewered homes in the impact case are expected to benefit from construction of sewage facilities in the baseline case, therefore, it is likely that these homes would be charged some portion of the baseline costs. The recent change in EPA policy may delay the construction of interceptors due to the added financial burden placed on local sewer authorities and households.

Stormwater Drainage Facilities

4.360
The analysis of impacts has been facilitated through the use of the SIMPACT IV Model. To facilitate the use of this model, certain assumptions had to be made. The first was that a certain percentage of the new subdivisions in each community would be storm sewered. Thus, the length of new storm sewers was expressed as a fraction of the total length of new streets (refer to Table 4-210). The second assumption was that some existing local streets, currently served by open drainage ditches would be storm-sewered.

4.361
The applicant expects that the population increases induced by the proposed plant would be limited primarily to the Principal Study Area, and therefore that the plant would have little or no impact on storm drainage facilities outside of this area. Additionally, projected population changes indicate that on a regional basis the Principal Study Area will remain relatively rural and the nature and extent of storm drainage infrastructure will remain relatively unchanged through the year 1990. The expected changes in drainage facilities are of two basic types: those associated with new developments and those associated with growth within existing communities. The applicant expects that most new developments, especially in communities with high population density, will be serviced by storm sewers. These small pockets of development will probably drain directly to a local water body and thus have little or no impact on preexisting storm drainage facilities in neighboring developments. The cost of storm sewers construction will be borne

Table 4-210

Assumptions Utilized in the SIMPACT IV Model—Length of New Storm Sewer as Related to the Length of New and Improved Local Streets

	Ratio of the Length of Storm Sewer to New Local Streets	Ratio of the Length of Storm Sewer to Improved Local Streets
City of Conneaut	.90	.90
Kingsville Township and Village	.54	.63
Ashtabula Township	.54	.63
Ashtabula City	.90	.90
Saybrook Township	.54	.63
Remainder of Ohio Principal Study Area	.54	.63
Springfield Township and East Springfield Village	.45	.54
Girard Area	.72	.81
Fairview Township and Borough	.90	.90
Millcreek Township	.90	.90
Remainder of Pa Principal Study Area	.45	.54

Source: Arthur D. Little, Inc. estimates.

primarily by the developer, although a small percentage of the cost will likely be absorbed by local Governments to provide outfalls for the runoff. Additionally, local Governments may request that the developer oversize the storm sewers in anticipation of future development in the drainage basin. Any such additional costs would most likely be carried by the local Government and maintenance costs, carried by local Government, are minimal. Within those existing communities where fairly intensive development is expected, costly improvements of existing storm drainage facilities may be required. Total replacement of existing networks by new storm sewers is not expected, except possibly in Conneaut, where certain neighborhoods are experiencing drainage problems under current conditions, and infiltration/inflow is a major wastewater treatment problem. Typical stormwater drainage facility improvements may include, but not be restricted to, the following: replacement of certain "key" roadside ditches with storm sewers having a greater drainage capacity. The new storm sewers would become an integral part of the existing drainage network, which may continue to include large numbers of open ditches; and installation of major storm sewer trunk lines. Such trunk lines would carry runoff from an area to the nearest body of water capable of handling the flow (usually a large stream). Such trunk lines may or may not parallel roads.

4.362
Severe drainage problems requiring immediate solution through the installation of major storm sewer lines are not anticipated, although certain localized problems (depending on the actual extent and sites of development) may be encountered. Many potential problems would not occur if local comprehensive storm drainage plans were implemented prior to 1981. The applicant anticipates that most of the required drainage improvements can be timed to coincide with road improvements or sanitary sewer installations, causing a minimum of disruption and expense. If, however, local Governments do not prepare comprehensive stormwater drainage plans before installation of required facilities, drainage problems could result and correction of drainage problems after development has occurred can be much more expensive. A more detailed analysis of the impacts in study area communities is presented in the following sections. The analysis has been enriched through the use of the SIMPACT IV Model. Using the model, storm sewer requirements (mileage and costs) resulting from lakefront plant-induced growth were estimated both for new subdivisions and for existing neighborhoods. The results of this analysis are presented in Tables 4-211 and 4-212. The figures presented are those estimated expenditures (and mileages) required to serve the lakefront plant-induced population in the study area during that year. Thus, in Fairview, local expenditures of approximately $75,000 would be required to provide drainage facilities to serve the

Table 4- 211

Estimated New Storm Sewer Requirements Involving Local Expenditure -- 1979-1990[1]

	Total Requirements by 1979		Total Requirements by 1981		Total Requirements by 1986		Total Requirements by 1990	
	Miles	Cost	Miles	Cost	Miles	Cost	Miles	Cost
City of Conneaut	<0.1	$ 6,000	0.2	$ 40,000	0.8	$160,000	1.1	$210,000
Kingsville Township and Village	0.1	11,000	0.3	60,000	0.4	80,000	0.4	75,000
Ashtabula Township	0	-	0.1	25,000	0.3	70,000	0.4	85,000
Ashtabula City	0	-	0	-	0	-	0	-
Saybrook Township	<0.1	≤ 6,000	0.2	30,000	0.1	35,000	0.1	25,000
Remainder of Ohio Principal Study Area	<0.1	≤ 6,000	0.2	40,000	0.3	55,000	0.2	45,000
Springfield Township and East Springfield Village	0	-	0.1	20,000	0.5	90,000	0.6	110,000
Girard Area	<0.1	≤ 6,000	0.2	30,000	0.3	60,000	0.4	75,000
Fairview Township and Borough	0.1	12,000	0.3	65,000	0.4	75,000	0.3	55,000
Millcreek Township	0.1	11,000	0.2	45,000	0.2	40,000	0.1	30,000
Remainder of Pa. Principal Study Area	0.1	11,000	0.3	60,000	0.2	50,000	0.2	45,000
Total[2]	0.4	$60,000	2.1	$425,000	3.5	$715,000	3.8	$760,000

(1) Requirements are associated with Lakefront Plant-induced growth only. Requirements do not include those storm sewers estimated for new developments at the expense of the developer. (See text). Estimates of baseline expenditures are unavailable.

(2) Figures may not add to totals due to rounding.

Note: Figures given are cumulative

Source: Storm Drainage Facilities baseline; Stormwater Drainage Working Paper; SIMPACT IV Model; Arthur D. Little, Inc. estimates.

Table 4- 212

Estimated New Storm Sewer Requirements - New Subdivisions -- 1979-1990(1)

	Total Requirements by 1979		Total Requirements by 1981		Total Requirements by 1986		Total Requirements by 1990	
	Miles	Cost	Miles	Cost	Miles	Cost	Miles	Cost
City of Conneaut	<0.1	≤$ 9,000	0.5	$ 79,000	1.6	$290,000	2.2	$390,000
Kingsville Township and Village	0.1	18,000	0.5	100,000	0.7	130,000	0.7	120,000
Ashtabula Township	0	0	0.2	41,000	0.6	110,000	0.7	130,000
Ashtabula City	0	0	0	0	0	0	0	0
Saybrook Township	<0.1	≤9,000	0.3	48,000	0.3	52,000	0.2	41,000
Remainder of Ohio Principal Study Area	<0.1	≤9,000	0.3	62,000	0.5	89,000	0.4	74,000
Sprinfield Township and East Springfield Village	0	0	0.2	31,000	0.8	140,000	1.0	170,000
Girard Area	<0.1	≤9,000	0.2	49,000	0.6	100,000	0.7	130,000
Fairview Township and Borough	0.1	22,000	0.7	120,000	0.8	140,000	0.6	100,000
Millcreek Township	0.1	21,000	0.5	88,000	0.4	70,000	0.3	51,000
Remainder of Pa. Principal Study Area	0.1	16,000	0.5	85,000	0.4	75,000	0.4	73,000
Total(2)	0.4	$98,000	3.9	$704,000	6.7	$1,200,000	7.2	$1,280,000

(1)Requirements are associated with Lakefront Plant-induced growth only. Requirements include only these storm sewers that would be constructed in new developments (primarily) at the expense of the developer. (See text.) Estimates of baseline expenditures are not available.

(2)Figures may not add to totals due to rounding.

Note: Figures given are cumulative.

Source: Storm Drainage Facilities baseline; Stormwater Drainage Working Paper; SIMPACT IV Model; Arthur D. Little, Inc. estimates.

lakefront plant-induced population in 1986, the year of peak population impact in Fairview. However, by 1990, the plant-induced population is projected to have decreased from the 1986 figure. Consequently, the expenditures for facilities for the 1986 population would be sufficient to meet the facility needs of the 1990 population and the $55,000 indicated for 1990 would not be required. Actual expenditures would be determined by local decision-makers in light of perceived requirements. In view of the anticipated high costs of storm sewer installations, the relative lack of outside funding and the limited budgets of the impacted communities, it is expected that most communities (with the possible exception of the city of Conneaut, Springfield Township and Millcreek Township) would, to varying extents, choose less costly alternatives to storm sewer installations. Such alternatives could include the installation of road drains or the expansion and upkeep of open ditching.

Local Study Area

4.363
New drainage facilities will probably be required in those existing neighborhoods where intensified growth is expected, at considerable expense to local Government. Outside funding, however, may be available. Drainage problems in new subdivisions are not expected since developers are required to provide adequate drainage.

City of Conneaut

4.364
An analysis of future storm sewer requirements (refer to Table 4-211) indicates that, in order to prevent drainage problems resulting from lakefront plant-induced growth, the city would be required to make continual storm drainage facility improvements through 1990. The total cost for the improvements could be as high as $200,000. Relatively minor Government expenditures would also be required for the construction of drainage facilities associated with new developments (most costs absorbed by the developer) and for the maintenance of the new infrastructure. As noted in the baseline, certain stormwater drainage facility improvements are currently required in the city of Conneaut. The needs, as identified by the City Engineer, include mapping the city's drainage system, development of comprehensive stormwater drainage plants, and storm sewer certain sections of North Conneaut, East Conneaut, and Amboy. (4-4) Prompt system mapping and drainage plan development would be required to avoid additional storm drainage problems. The improvement of drainage facilities in North Conneaut, East Conneaut, and Amboy, if delayed, will become more costly as development continues. Prevention and/or correction of drainage problems within the city will be eased (from an engineering standpoint) by the general availability of receiving

surface waters (including Conneaut Creek and its tributaries and small streams draining into Lake Erie). However, increased urban drainage to any streams in Conneaut other than Conneaut Creek would generally create an adverse on the aquatic biota primarily because of their extremely limited size and assimilative capacity.

Springfield

4.365
The results of the SIMPACT IV Model analysis (refer to Table 4-211) indicate that, in order to prevent drainage problems resulting from lakefront plant-induced growth, the local Governments would be required to make continual storm drainage facility improvements through 1990, at a total cost as high as $110,000. Relatively minor Government expenditures might also be required for the construction of drainage facilities associated with new developments (most costs absorbed by the developer) and for the maintenance of the new system.

Springfield Township

4.366
Most of Springfield Township is very flat, and many areas support wetland vegetation. In order to avoid drainage problems, it may be necessary for the township to require storm sewers in new subdivisions and to install some trunk lines. The new subdivision ordinance (adopted late in the summer of 1977) requires an "adequate drainage system" in new subdivisions with storm sewer connection required to any existing system running within 1,000 feet of the subdivision. It is probable, however, that storm sewer requirements might be less than those projected in Table 4-211, since even with its high projected population growth, the township will remain relatively rural through 1990 (refer to Table 4-213). Actual storm drainage requirements in the township will be very dependent on the nature and location of development. To avoid potential additional and costly drainage problems associated with plant-related development, Springfield Township would need to develop a comprehensive drainage plan prior to 1980.

East Springfield Borough

4.367
In the more densely populated East Springfield, lakefront plant-induced growth would almost certainly result in requirements for storm sewers. It is anticipated that additional drainage problems would develop in this area if storm sewers are not required in the new subdivision. Such problems would be the responsibility of the municipal Government and would be costly to alleviate. These costs were not included in the projections in Table 4-211. As in

Table 4-213

Projected Population Changes in the Principal Study Area

	Population Density (Persons/Acre)			Population			Percentage of 1990 Population Linked to Lakefront Plant (2)	Percentage of Population Increase (1975-1990) Linked to Lakefront Plant (3)
	1975 Baseline	1990 Baseline	1990 Impact (1)	1975 Baseline	1990 Baseline	1990 Impact		
Conneaut City	0.84	0.90	1.20	14,700	15,800	21,065	25	83
Kingsville Township & Village	0.34	0.44	0.52	4,700	6,050	7,255	17	47
Ashtabula Township	0.89	0.99	1.19	7,600	8,500	10,190	17	65
Ashtabula City	5.13	4.57	4.68	24,300	21,650	22,190	2	-
Saybrook Township	0.33	0.44	0.45	6,700	8,900	9,170	3	11
Rest of Ohio Principal Study Area	-	-	-	16,950	18,000	18,815	4	44
Springfield Township-& Borough	0.13	0.17	0.29	3,200	4,000	6,830	41	78
Girard Area	0.37	0.47	0.52	8,800	11,150	12,345	10	34
Fairview Township & Borough	0.47	0.62	0.65	8,500	11,300	11,830	4	16
Millcreek Township	2.09	2.44	2.47	39,000	45,600	46,115	1	7
Rest of Pennsylvania Principal Study Area	-	-	-	196,850	211,950	212,805	<1	6

(1) Projected population density (including baseline), assuming Lakefront Plant Construction.

(2) Calculated as follows: $\frac{\text{Total Lakefront Plant-induced Population by 1990}}{\text{Total Population (Impact \& Baseline) in 1990}} \times 100$

(3) Calculated as follows: $\frac{\text{Total Lakefront Plant-induced Population by 1990}}{\text{Total Population (Impact \& Baseline) in 1990-Total Population (Impact \& Baseline) in 1979}} \times 100$

Source: Population baseline; Construction Labor Requirements and Characteristics, and Economics and Demographics Operations Phase Working Papers; SIMPACT IV Model.

Springfield Township, additional and unnecessary drainage problems could be avoided if the borough developed comprehensive drainage plans. Since East Springfield is already densely populated relative to the township, the immediate development of such plans is even more critical in the borough than in the township.

Ohio and Pennsylvania Principal Study Area and Selected Coastal Communities

4.368
In Ashtabula Township and the Girard Area, drainage requirements are projected to increase continually through 1990. In the remainder of the Principal Study Area requirements are projected to peak between 1981 and 1986. The applicant expects that by 1990 they will have stabilized at between 60 percent and 90 percent of their maximum level. In these areas, it is expected that the degree of urbanization required to meet all the needs of the transient population might not be achieved. Consequently, the peak storm sewer requirements indicated might never be realized. The effects of lakefront plant-induced growth on drainage in each municipality are dependent on a number of factors, including the total growth rate, the percentage of growth induced by the plant, existing drainage facilities and problems, and, the extent of local comprehensive storm drainage plants.

Kingsville Township and North Kingsville Village

4.369
Although Kingsville Township has no storm sewers, drainage is expected to be adequate through 1990 under either baseline or impact conditions. Currently, developers are not required to install storm sewers in new subdivisions, and unless action is taken on a county level, this regulation is not expected to change. In anticipation of future growth, the township may consider the installation of the storm sewers in conjunction with the anticipated sanitary sewer installations. Storm drainage in North Kingsville consists of storm sewering and open ditching. Each year, improvements are made on the system to the extent that funding is available (within the past year, $8,700 was allocated for this purpose). Storm drainage facility maps will soon be completed, and through the function of the Planning Commission, it is expected new developments would not create drainage problems for the village.

Ashtabula Township

4.370
Approximately five percent to 10 percent of Ashtabula Township is equipped with storm sewers and no future municipal storm drainage

improvements are planned. Maps of the township drainage system are currently being prepared and will improve the ability of the township to plan for and absorb future growth. The expected growth, however, is great enough that by 1990 a significant revision of drainage facilities (i.e., the replacement of numbers of open ditches by storm sewers) would be required. If required improvements are not commenced before substantial development has occurred, then the cost of such improvements will increase greatly.

Ashtabula City

4.371
Ashtabula City has a well-developed storm sewer network and could absorb the projected lakefront plant-induced growth with minimal impact on drainage.

Saybrook Township

4.372
Storm drainage in Saybrook Township currently consists of open ditching and road drains, which in several portions of the township is inadequate. No comprehensive system maps have been prepared, due to lack of funds. Similarly, funding is not available for drainage improvements in the township. The pollution of road drains and ditches with sanitary sewerage is a severe problem. Saybrook is currently unprepared for baseline growth with respect to drainage facilities. The projected growth associated with the lakefront plant (14 percent of the total expected growth through 1990) would aggravate baseline drainage problems.

Rest of Ohio Principal Study Area

4.373
The lakefront plant-induced growth in the rest of the Ohio Study Area is expected to be relatively limited, therefore, the impact of this growth on the drainage in any particular township or borough is expected to be minimal.

Girard Area

4.374
Girard, Platea, and Lake City Boroughs in the Girard Area have proceeded with system mapping and/or storm drainage studies to prepare for baseline growth. In the more developed boroughs, (Girard and Lake City) subdivision regulations have been adopted requiring storm sewer installations on new development sites. (4-5) Therefore, the additional lakefront plant-induced growth could be handled in these areas with relatively minor impact on drainage. Impacts are likely

to be most severe in Lake City Borough, where the current storm drainage system is fairly limited. Girard Township has neither adopted local subdivision regulations requiring storm sewer installations nor proceeded with mapping and comprehensive drainage studies. Although rural drainage (e.g., open ditching) is expected to suffice throughout most of the township through 1990 under either baseline or impact conditions, drainage problems may develop in some areas adjacent to the more developed boroughs. Potential drainage problems in these areas have been anticipated under baseline growth conditions. (4-5) However, more severe problems would be expected if the Lakefront Plant is constructed.

Fairview Township and Borough

4.375
Although storm sewers are required on new development sites in Fairview Borough, the present storm water drainage system is limited. A similar situation exists in Fairview Township, where a comprehensive drainage plan is required for efficient planning under baseline growth conditions. If the lakefront plant is constructed, the growth rate in the Fairview area is projected to increase by approximately 25 percent over the 1990 baseline projections. The impact of the lakefront plant-induced growth would therefore aggravate any baseline drainage problems and to render those problems more costly to correct.

Millcreek Township

4.376
Millcreek Township is equipped with a well-developed storm sewer network and has developed comprehensive storm drainage plans. The relatively minor projected influx of lakefront plant-induced population would have little impact on drainage facilities in this municipality.

Rest of Pennsylvania Study Area

4.377
The lakefront plant-induced growth in the rest of the Pennsylvania Principal Study Area is expected to be relatively limited. The applicant expects that the impact of this growth on the drainage in any particular township or borough to be minimal.

Solid Waste Collection and Disposal

a) System Providing Service

4.378
The tonnage of waste associated with secondary growth during the construction and operations phases of the proposed project is not

expected to significantly affect the overall solid waste management system presently operating in the Principal Study Area. This system comprises State planning and permitting of sanitary landfills, county monitoring of sanitary landfills, municipal zoning and some solid waste collection, and private sector solid waste collection and disposal. The private sector is responsible for most of the solid waste collection and all of the solid waste disposal in the Principal Study Area. Private Contractors now operate in an open and competitive market, with little governmental regulation. With the location of the proposed U.S. Steel facility in the area, there might be an increase in the number of Contractors operating or an expansion of present contract operations.

b) Collection in the Local Study Area and Coastal Communities

4.379
No significant impact is expected on collection activity in the Local Study Area and Coastal Communities. In the Local Study Area, private Contractors presently operating on demand should be able to accommodate the modest increase in service requirement. Expected solid waste generation for the Local Study Area is shown in Figures 4-34 through 4-36 while Table 4-214 projects the total waste generated as a result of the proposed facility. The town of Springfield currently has no collection system. Generally, citizens dispose of wastes at an open dump authorized by the Erie County Solid Waste Authority but not permitted by the State. The Authority made this exception for the area because there was no other feasible alternative. A change will be mandated, not by construction and operation of the proposed steel plant, but rather from the enforcement of regulations in Section 4005 of the Resource Conservation and Recovery Act of 1976 (Public Law 94-580), regarding open dumps. The Act defines the term "open dump" as "any facility or site where solid waste is disposed of which is not a sanitary landfill which meets the criteria promulgated . . . and which is not a facility for disposal of hazardous waste." Thus, the Authority or the State of Pennsylvania will be required to comply with any measures promulgated by the Administrator of the Environmental Protection Agency within six years after criteria classifying open dumps is published or before October, 1983. When the Springfield dump is closed, a collection service of some type will need to be instituted. The most common type of collection vehicle used in the area is the 20-cubic yard rear end loader compactor. One such vehicle picks up approximately 10 tons of refuse per paid eight-hour day, or 2,600 tons per year (assuming a five-day week, 52 weeks a year). Thus, in Conneaut, six vehicles would be required to serve the 1990 baseline population, while two additional vehicles would be needed to collect the additional waste load generated as a result of secondary growth associated with the proposed plant. In Springfield, one vehicle could serve the baseline

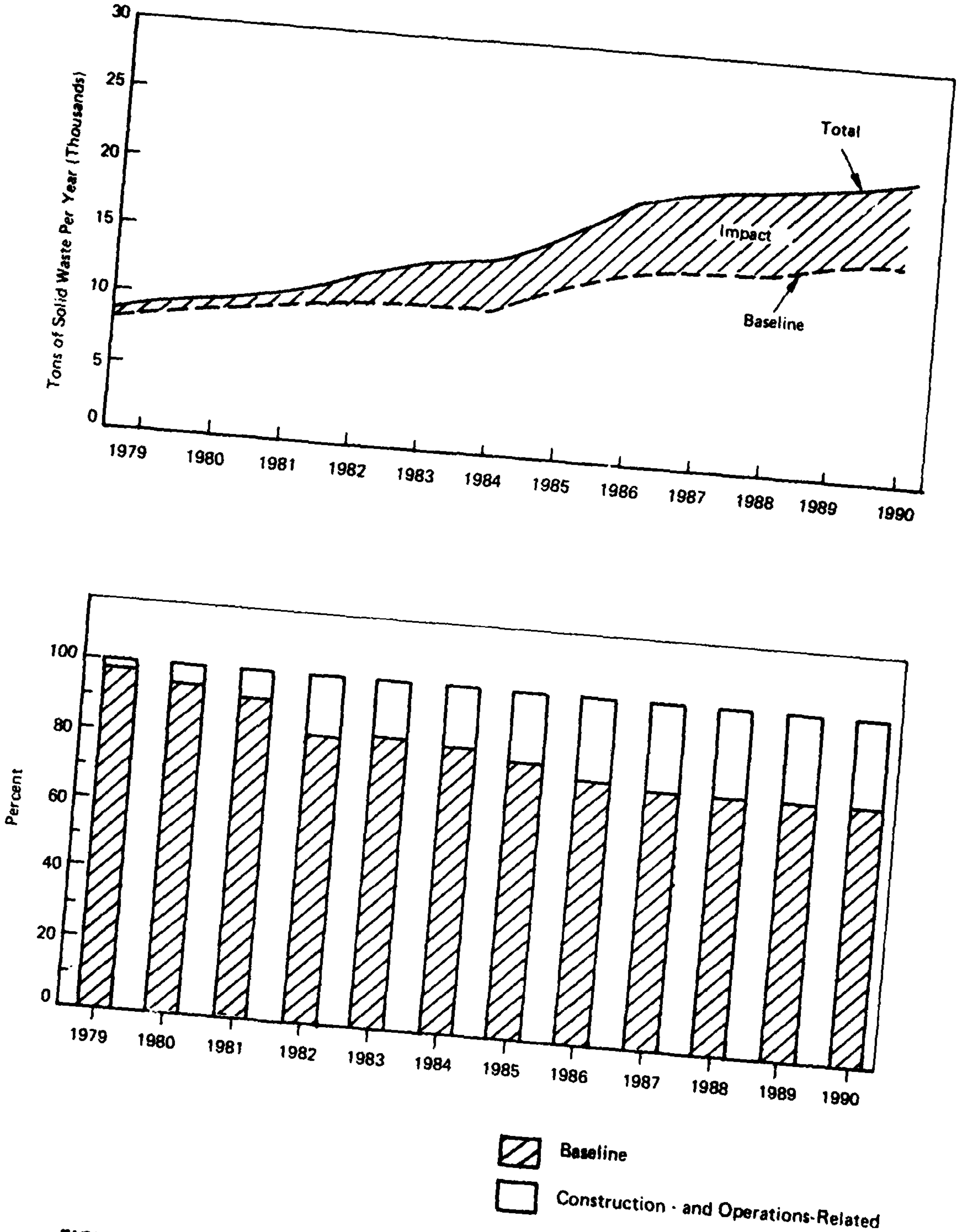
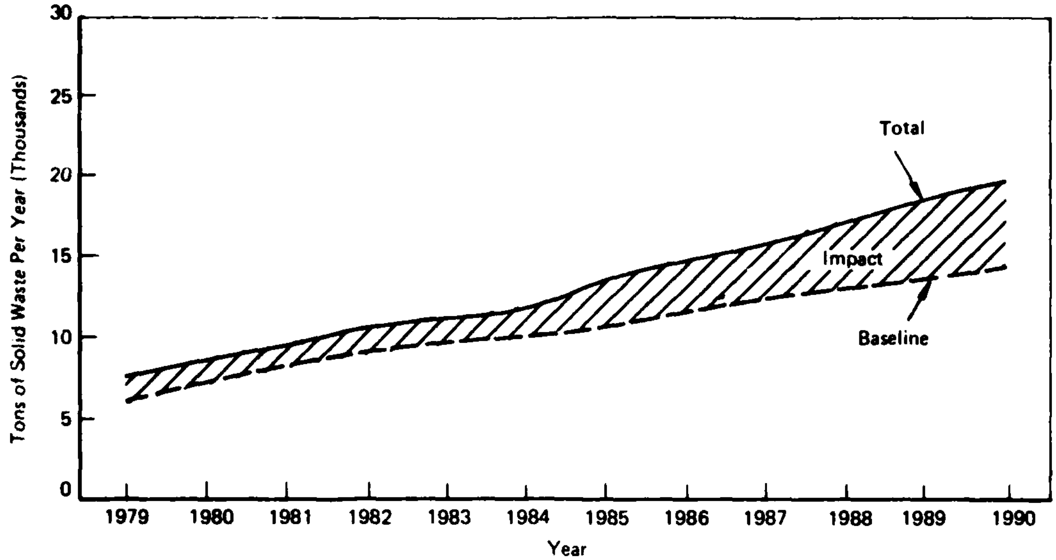


FIGURE 4–34 EXPECTED WASTE GENERATION FOR THE LOCAL STUDY AREA – 1979–1990



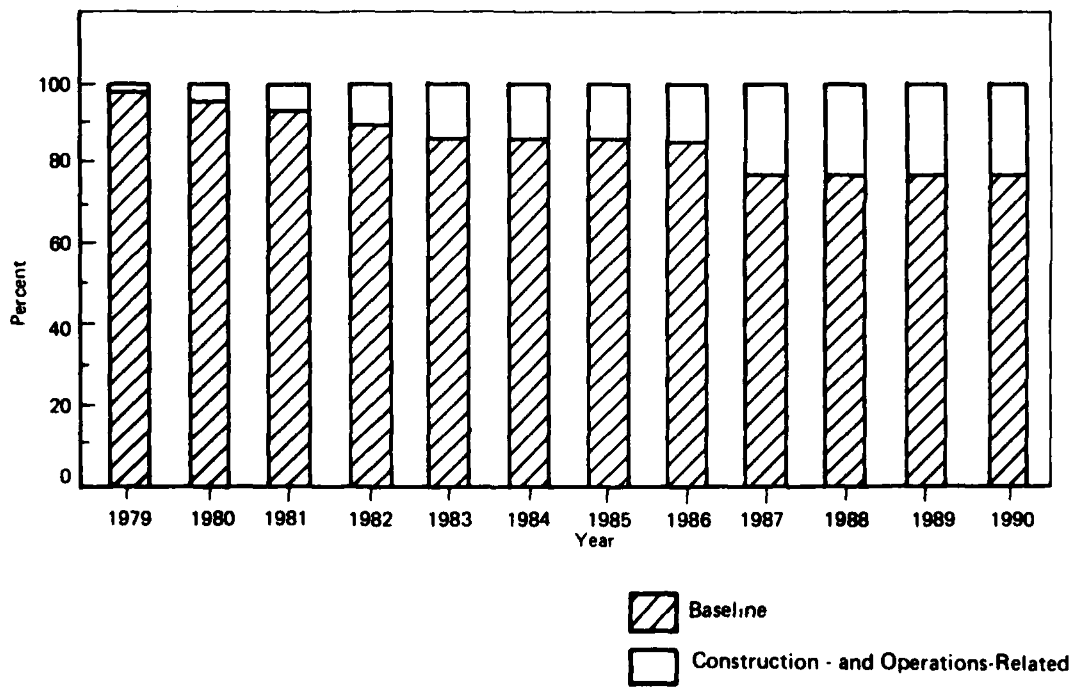
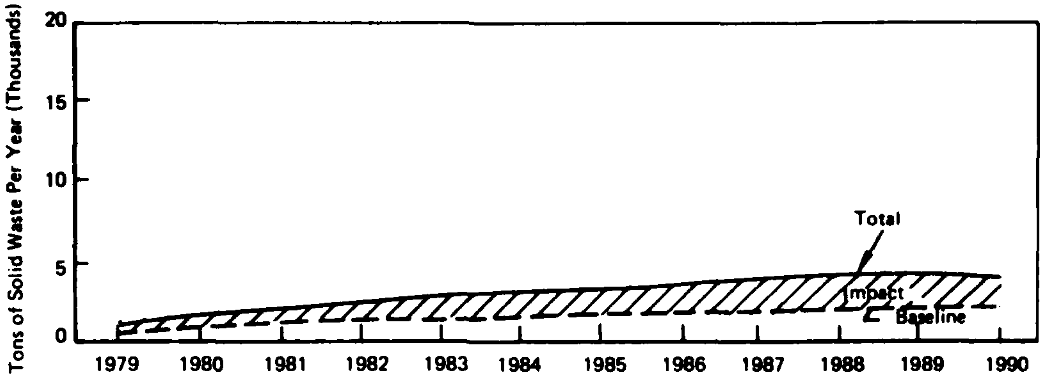


FIGURE 4–35 EXPECTED WASTE GENERATION FOR CONNEAUT CITY – 1979–1990



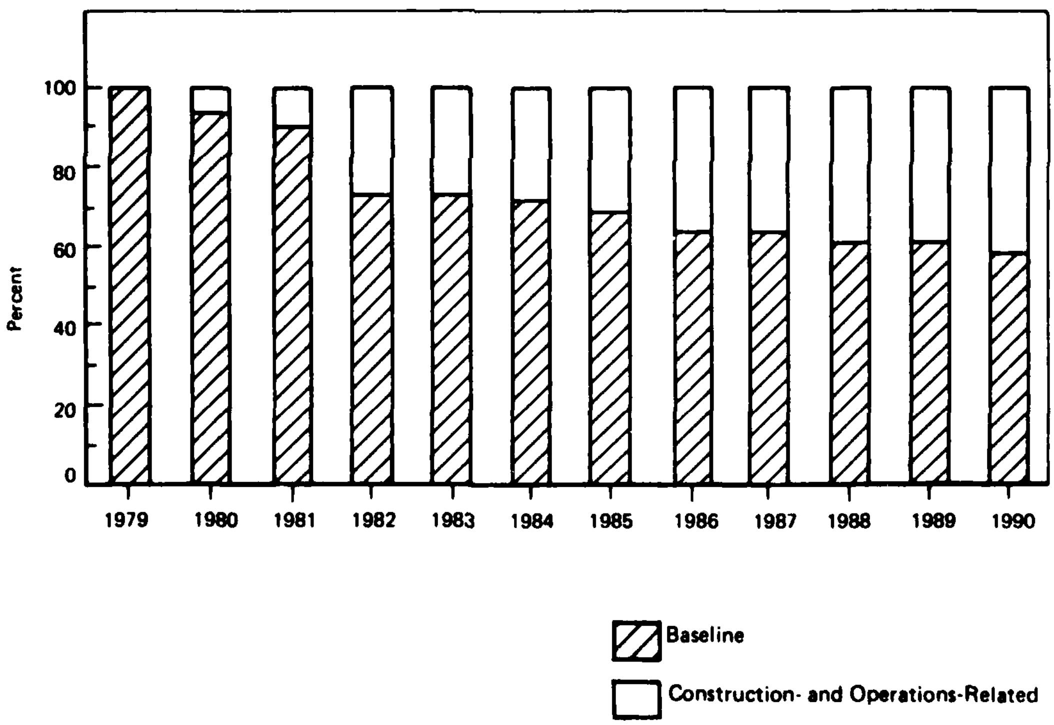


FIGURE 4–36 EXPECTED WASTE GENERATION FOR SPRINGFIELD – 1979-1990

Table 4- 214

Projected Solid Waste in the Local Study Area -- 1979-1990
(Tons per Year)

	1979	1981	1986	1990
Construction-Related Growth				
Local Study Area	12	329	215	0
Conneaut	12	267	186	0
Springfield	0	62	29	0
Operations-Related Growth				
Local Study Area	0	424	3,883	6,156
Conneaut	0	283	2,783	4,710
Springfield	0	141	1,100	1,446
Total Impact				
Local Study Area	12	755	4,096	6,156
Conneaut	12	551	2,968	4,710
Springfield	0	204	1,128	1,446
Baseline				
Local Study Area	8,143	9,604	13,254	16,174
Conneaut	6,592	7,963	11,389	14,130
Springfield	1,551	1,641	1,865	2,044
Total Impact as a Percent of Baseline				
Local Study Area	0.1%	8.0%	31.0%	38.1%
Conneaut	0.2	7.0	26.1	33.3
Springfield	0.0	12.4	60.5	70.7

Source: Solid Waste baseline; Solid Waste Working Paper; SIMPACT IV Model.

population and the proposed project would generate the need for one additional vehicle by 1990.

4.380
For the Coastal Communities, in 1990, the total impact of waste generated as a result of the proposed facility is almost five percent of the baseline figure (refer to Table 4-215). Again, assuming the continuous use of 20-cubic-yard rear end loader compactors in the area, only two Coastal Communities would require additional vehicles to accommodate the expected waste associated with the proposed facility. In Ashtabula City and the Girard Area, the number of vehicles required to serve the 1990 baseline population would be 11 and three, respectively, while both communities would require one additional vehicle to handle the waste generated by the plant-induced population. In 1990, the remaining Coastal Communities of Kingsville, Ashtabula Township, Saybrook, Fairview, and Millcreek would require two, two, two, three, and 10 vehicles, respectively, to serve the baseline population. The additional waste generated from the proposed facility would not require more vehicles, but would be expected to increase the capacity/utilization rate of the vehicles in each community.

c) Disposal in the Regional Study Area

4.381
The adequacy of landfill facilities is already a critical issue in the solid waste management functions of the Regional Study Area. The increased tonnage of waste that would result from the location of the proposed facility in the area would have a small impact on the lifetimes of the permitted landfills that must be provided for the baseline population. Presently, three sanitary landfills serve the entire Regional Study Area -- New Lyme and Doherty in Ashtabula County, and Lakeview in Erie County. The tonnage of waste received daily and the projected baseline lifetimes of New Lyme, Doherty, and Lakeview are respectively: 20 tons per day over 100 years, 60 tons per day over 27 years, and 550 tons per day over 1-1/2 years. A permit request to expand the Lakeview facility could extend baseline operations for 12 years if granted; a denial, on the other hand, could possibly decrease the operational lifetime of New Lyme and Doherty to 10-1/2 and seven years, respectively. In 1979, the additional amount of waste to be disposed of because of secondary growth associated with the proposed facility will be 236 tons per year. By 1990, the plant-induced amount would be 11,822 tons annually. Assuming the waste is disposed of equally among the three landfills in the Regional Study Area, the incremental quantity going to each is 0.22 ton per day in 1979 and 10.8 tons per day in 1990. These figures may be compared to baseline quantities of 310 tons per day in 1979 and 419 tons per day in 1990, again assuming equal distribution

Table 4- 215

Projected Solid Waste in the Coastal Communities -- 1979-1990
(Tons per Year)

	1979	1981	1986	1990
Construction-Related Growth				
Coastal Communities	98	1,677	889	0
Kingsville Township and Village	31	207	111	0
Ashtabula Township	0	106	56	0
Ashtabula City	0	422	224	0
Saybrook Township	8	114	57	0
Girard Area	11	172	81	0
Fairview Township and Borough	23	190	101	0
Millcreek	25	466	259	0
Operations-Related Growth				
Coastal Communities	0	698	2,643	3,669
Kingsville Township and Village	0	157	455	594
Ashtabula Township	0	118	612	834
Ashtabula City	0	53	476	720
Saybrook Township	0	91	129	134
Girard Area	0	144	608	851
Fairview Township and Borough	0	90	224	262
Millcreek	0	45	139	274
Total Impact				
Coastal Communities	98	2,375	3,532	3,669
Kingsville Township and Village	31	364	566	594
Ashtabula Township	0	224	668	834
Ashtabula City	0	475	700	720
Saybrook Township	8	205	186	134
Girard Area	11	316	689	851
Fairview Township and Borough	23	280	325	262
Millcreek	25	511	398	274

Table 4-215 (Continued)

	1979	1981	1986	1990
Baseline				
Coastal Communities	66,921	68,942	73,992	78,035
Kingsville Township and Village	2,256	2,388	2,717	2,981
Ashtabula Township	3,460	3,592	3,923	4,188
Ashtabula City	28,246	28,355	28,626	28,843
Saybrook Township	3,241	3,449	3,969	4,385
Girard Area	6,004	6,355	7,233	7,936
Fairview Township and Borough	4,117	4,381	5,040	5,568
Millcreek	19,597	20,422	22,484	24,134
Total Impact as a Percent of Baseline				
Coastal Communities	0.2%	3.4%	4.8%	4.7%
Kingsville Township and Village	1.4	15.3	20.8	20.0
Ashtabula Township	0.0	6.2	17.0	20.0
Ashtabula City	0.0	1.7	2.4	2.5
Saybrook Township	0.2	6.0	4.7	3.0
Girard Area	0.2	5.0	9.5	10.7
Fairview Township and Borough	0.6	6.4	6.4	4.7
Millcreek	0.1	2.5	1.8	1.1

Source: Solid Waste baseline; Solid Waste Working Paper; SIMPACT IV Model.

among the three landfills. The impact of wastes generated for disposal in the Principal Study Area as a result of the proposed steel plant is presented in Table 4-216 and Figure 4-37.

d) Administration

4.382
No change is expected in governmental units responsible for the overall administration of solid waste management in the Principal Study Area.

e) Equipment and Vehicles

4.383
Private waste collectors operating in the Local Study Area and Coastal Communities would have to make modest additions to present equipment and vehicles to accommodate the additional waste generated as a result of the proposed facility.

f) Cost of Service

4.384
The impact on collection and disposal costs resulting from the proposed facility is unknown. The costs for municipalities increase annually because of wages, benefits, and operating expenses. Private Contractors may not show an increase in costs because of more efficient operations, and better utilization of current capacity. Under baseline conditions, costs may increase for both municipal and private operations if adequate disposal facilities are not provided. For example, longer hauling distance to disposal facilities in other counties or States would certainly be reflected in operating expenses as an increase in transportation costs. Citizens serviced by a municipality or private Contractors would become aware of the increase in the baseline case through higher taxes or monthly rates. No incremental increases are anticipated, however, as a direct result of the proposed facility.

g) Landfill Facilities -- Capacity/Utilization

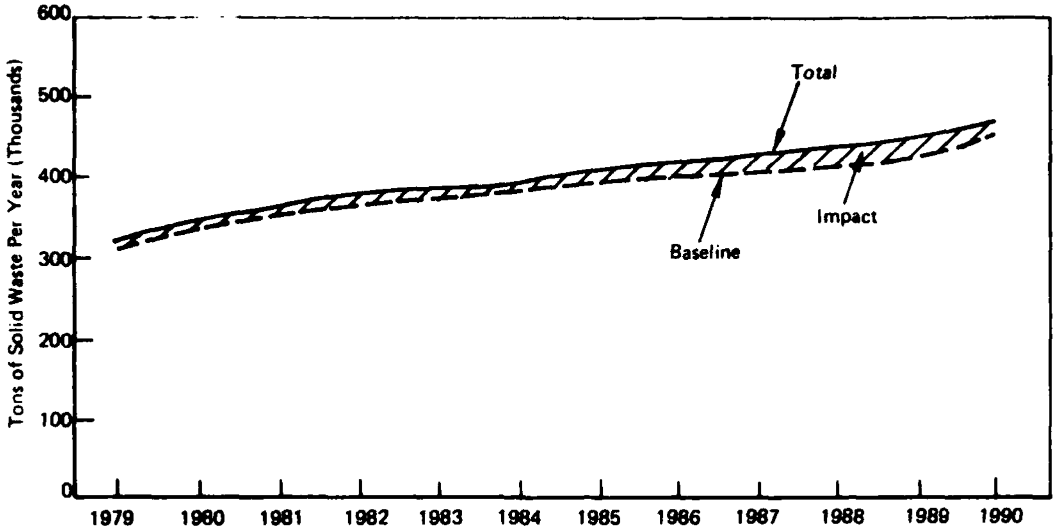
4.385
Presently, the landfill capacity in the Regional Study Area is inadequate. The three landfills serving the entire three-county region accommodate only 630 tons of the total 1,468 tons generated daily while the rest may go to other counties or States; some may be open dumped. At the present waste generation rate of 536,000 tons per year, the required landfill space is about 858 acre-feet per year. Utilizing the projected 1990 baseline population and waste generation rates, approximately 670,000 tons of waste would be generated

Table 4-216

Projected Solid Waste in the Principal Study Area -- 1979-1990
(Tons/Year)

	1979	1981	1986	1990
Construction-Related Growth	236	3,673	2,011	0
Operation-Related Growth	0	1,476	7,648	11,822
Total Impact	236	5,148	9,660	11,822
Baseline	339,887	361,534	415,650	458,943
Total Impact as a Percent of Baseline	0.07%	1.4%	2.3%	2.6%

Source: Solid Waste baseline; Solid Waste Working Paper; SIMPACT IV Model.



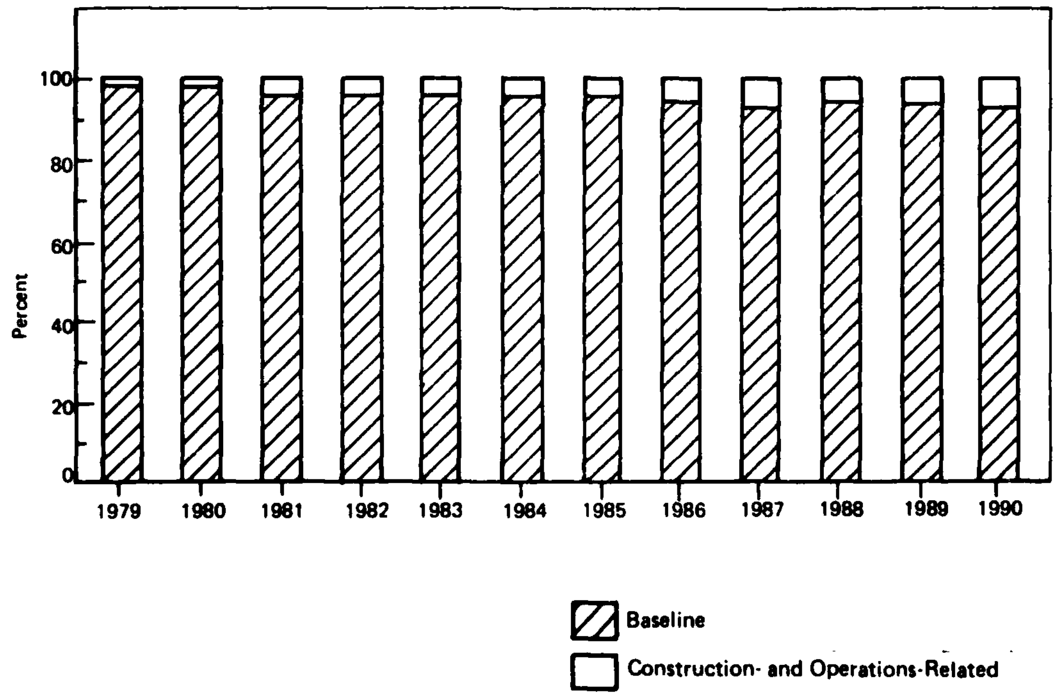


FIGURE 4–37 EXPECTED WASTE GENERATION IN THE PRINCIPAL STUDY AREA – 1979-1990

requiring a landfill capacity of 1,070 acre-feet. From 1979 to 1990, a total of 139 acre-feet (13 percent of baseline) would be required to dispose of the additional waste generated in the Principal Study Area as a secondary result of the proposed facility being located in the area. Over 1979-1990, approximately 402 acres with a 30-foot depth would be required for adequate landfill disposal for the baseline population. The plant-induced population would require five acres, increasing the total acreage to 407. The fill area currently available in the region is 242 acres, assuming the proposed Lakeview expansion is permitted. By 1979, the area available will have been reduced by about 60 acres. If present trends continue, by 1990 the Regional Study Area would fall short about 220 acres in the baseline case and 225 acres if the proposed U.S. Steel plant is built.

h) Planned Additions of Disposal Facilities

4.386
The States of Ohio and Pennsylvania are presently planning studies which will investigate solid waste management problems (particularly provision of adequate landfill capacity or alternative disposal methods) and their possible resolutions. There has been some interest in implementing community resource recovery centers in the Regional Study Area. However, a very large capital investment is required for a plant of any size and a minimum amount of waste is required daily for economic operations. The consensus of the solid waste engineering community is that 200 to 250 tons per day is the lower limit and that plants operating in the 500 to 2000-tons-per-day range are likely to be more economical. Thus, resource recovery appears most feasible for densely populated areas with large quantities of solid waste transported to a single location. Presently, no individual coastal community generates more than over 100 tons of waste per day. By 1990, the Ohio Principal Study Area would only generate 194 tons of waste per day; however, Erie County would generate enough waste for the operation of a medium-size plant. Several sites in the Regional Study Area have been surveyed and declared hydrogeologically acceptable; however, the degree of public opposition is enormous to any expansions or new constructions. Both public officials and private landfill operators indicate that affirmative permitting and zoning decisions will be politically possible only under conditions of crisis. It is not possible to predict where the landfills will be located, how many there will be, or even whether they will all be located within the Regional Study Area. Wastes for disposal currently do cross State and county lines and we are likely to continue to do so, despite the fact that transportation costs can be a major factor in the economics of disposal.

Traffic and Transportation Facilities

a) Highway Transportation Requirements

Lakefront Plant Automobile Traffic

4.387
Construction-Related. The applicant estimates that the number of construction workers would peak at approximately 10,500 and that this maximum would be reached during Step I construction. Workers would approach the plant via two access roads (one entering from the Ohio side and the other from the Pennsylvania side) and park in one of two parking lots, located within the proposed site boundaries. Workers would be transported by the Contractor from the parking lots to the job site. Construction activity is scheduled on a one shift running from 8:00 a.m. to 4:30 p.m.. Workers would arrive during the period from 7:00 to 7:45 a.m., with the maximum influx occurring near the end of this time interval. Based on actual counts at a facility now under construction in a rural location, the applicant estimates that there will be an average of 2.5 construction workers per automobile. Thus, there would be approximately 4,200 automobiles traveling to and from the construction site each day. Workers departing from the site would do so during the period from 4:45 p.m. to 5:30 p.m., with maximum traffic flows occurring near the beginning of this period. Step II construction would involve approximately 6,500 workers in addition to the employees operating the portions of the plant which were completed in Step I. Under these conditions the daily influx of automobiles would amount to 8,646.

4.388
Operations-Related. Arrivals and departures of employees during Step I and Step II operations are shown in Tables 4-217 and 4-218. These data are based on the travel pattern of employees at U.S. Steel's Fairless Works. Vehicles entering the plant contain one person at the Fairless Works and the same occupancy rate is assumed for the new facility, although higher energy costs and fuel availability may dictate otherwise. Single car occupancy was selected to portray the worst case traffic condition. Typical arrival and departure patterns were developed for four general categories of employees: officers and managers, professionals; technical, office and clerical; and wage earners, each group of which has slightly different diurnal work patterns. The tables, however, show all employees combined. The total number of employees is 5,380 in Step I and about 8,450 in Step II. The applicant expects that approximately 55 percent of the employees would arrive from and depart to the west immediately at the boundaries of the plant. The remaining 45 percent will arrive and depart in an eastward direction. These data are shown in Table 4-219.

Table 4- 217

Estimated Lakefront Plant Employee Auto Traffic During Step I Operations

Weekdays-Mornings			Weekdays-Afternoons			Weekdays-Evenings		
Time	Arriving	Departing	Time	Arriving	Departing	Time	Arriving	Departing
6:00-6:10 a.m.	21		2:00-2:10 p.m.	16		10:00-10:10 p.m.	16	
6:10	25		2:10	18		10:10	18	
6:20	93		2:20	75		10:20	75	
6:30	152		2:30	140		10:30	140	
6:40	105		2:40	87		10:40	87	
6:50	126		2:50	118		10:50	118	
7:00	183	255	3:00	166	266	11:00	166	255
7:10	120	51	3:10	97	59	11:10	97	51
7:20	198	9	3:20	123	21	11:20	123	9
7:30	195	310	3:30	144	329	11:30	144	310
7:40	369	64	3:40	132	74	11:40	132	64
7:50	121	13	3:50-4:00 p.m.	53	22	11:50	53	13
8:00		369	4:00		297	12:00-12:10 a.m.		369
8:10		73	4:10		70	12:10		73
8:20		13	4:20		24	12:20		13
8:30		4	4:30		364	12:30		4
8:40		3	4:40		101	12:40		3
8:50-9:00 a.m.		2	4:50		54	12:50-1:00 a.m.		2
			5:00		17			
			5:10		7			
			5:20-5:30 p.m.		5			

Source: United States Steel Corporation estimates.

Table 4- 218

Estimated Lakefront Plant Employee Auto Traffic During Step II Operations

Weekdays-Mornings			Weekdays-Afternoons			Weekdays-Evenings		
Time	Arriving	Departing	Time	Arriving	Departing	Time	Arriving	Departing
6:00-6:10 a.m.	31		2:00-2:10 p.m.	24		10:00-10:10 p.m.	24	
6:10	37		2:10	27		10:10	27	
6:20	139		2:20	111		10:20	111	
6:30	226		2:30	209		10:30	209	
6:40	157		2:40	129		10:40	129	
6:50	187		2:50	175		10:50	175	
7:00	278	380	3:00	253	396	11:00	253	380
7:10	184	76	3:10	150	88	11:10	150	76
7:20	321	14	3:20	209	31	11:20	209	14
7:30	344	461	3:30	264	489	11:30	264	461
7:40	576	95	3:40	221	110	11:40	221	95
7:50	194	19	3:50	91	33	11:50	91	19
8:00		658	4:00		555	12:00		658
8:10		128	4:10		124	12:10		128
8:20		19	4:20		35	12:20		19
8:30		6	4:30		541	12:30		6
8:40		4	4:40		150	12:40		4
8:50		3	4:50		80	12:50-1:00 a.m.		3
			5:00		25			
			5:10		10			
			5:20		7			

Source: United States Steel Corporation estimates.

Table 4-219

Estimated Lakefront Plant Two-Way Auto Traffic Volumes by Step

Hour	Step I West	Step I East	Step II(1) West	Step II(1) East
6:00-7:00 a.m.	289	233	431	346
7:00-8:00	1044	844	1633	1309
8:00-9:00	257	207	454	364
2:00-3:00 p.m.	251	203	375	300
3:00-4:00	822	664	1296	1039
4:00-5:00	503	407	824	661
5:00-6:00	16	13	23	19
10:00-11:00	251	203	375	300
11:00-12:00	784	633	1235	998
12:00-1:00 a.m.	257	207	454	364

(1) Includes Step I.

Source: United States Steel Corporation estimates.

Lakefront Plant Truck Traffic

4.389
Construction-Related. The applicant anticipates that 60,000 truckloads of construction materials and plant equipment will be utilized in the construction phase. Assuming that the consumption of materials and use of equipment will be roughly proportional to construction manpower expended in building the plant, it is possible to estimate a truck traffic schedule for construction. The total number of truckloads was therefore distributed by yearly quarters (for which construction employment has been estimated) but two months in advance to ensure that materials and equipment are onsite before needed. Transportation of materials was assumed to begin five months before these materials are actually needed.

4.390
The first construction peak quarter is expected to account for 8.9 percent of the total construction employment for both Step I and II combined. When applied to the 60,000 truckloads expected, this results in 5,334 trucks over a three-month period beginning five months before the construction peak and ending two months before that peak. Assuming a five-day work week, (65 working days per quarter) during which arrivals would be evenly distributed, 82 trucks would be expected to enter and leave the plant on a daily basis (164 trips). Since construction operations occur over an eight hour period, the applicant expects that there would be an average of approximately 21 arrivals and departures per hour. Most of the trucks entering and leaving the site will be Class 8 vehicles (over 33,000 GVW), of which more than 95 percent would be diesel powered.

4.391
In addition to the trucks required to transport construction materials and plant equipment, the applicant has estimated that approximately 1,800 pieces of construction equipment will be in use onsite during peak construction including bulldozers, scrapers, off-road dump trucks, as well as other types of equipment. If all this equipment were to arrive during one quarter of the year (a worst case situation since some significant but undeterminable percentage of it would obviously have to be in place before the peak), there would be an average of 56 arrivals and departures per day if all were carried on a flatbed or equivalent vehicle rather than being self propelled. Thus, at worst, seven vehicles would arrive and depart per hour. Few pilings would be required and sand and gravel for foundations will arrive at the site by barge. Therefore, the upper limit on peak construction truck traffic is estimated to be 164 individual trips for construction materials and plant equipment plus 56 trips for construction equipment brought to the site. This results in a high estimate of around 220 trucks per day or around 28 per hour for the eight-hour shift.

4.392
Operations-Related. Estimates of annual truck tonnage for operation of the lakefront plant for Steps I and II are presented in Table 4-220. The estimated truck traffic through the gate located in Ohio and the gate located in Pennsylvania for Step I and Step II operations is shown separately in Table 4-206. The estimates were based on the assumption that Ohio trucks will carry 25.3 tons each and Pennsylvania trucks will carry 22.4 tons each. The applicant further assumes that 70 percent of outbound iron and steel will move west through the Ohio gate, along with outbound slag and miscellaneous bulk shipments. Fifteen percent of the outbound iron and steel tonnage will be shipped during the midnight to 8:00 a.m. shift, 35 percent during the 8:00 a.m. to 4:00 p.m. shift, and 50 percent during the 4:00 p.m. to midnight shift. All inbound refractories, clay and sand, and 85 percent of the remaining inbound materials are assumed to move through the Ohio gate. Inbound shipments will be received 80 percent on the 8:00 a.m. to 4:00 p.m. shift and 20 percent in the 4:00 p.m. to midnight shift through the same gate. The translation of the tonnages shown in Table 4-220 into truckloads is shown in Table 4-221. Peak monthly figures represent a 20 percent increase over the average monthly numbers, based upon the applicant's experience at other locations. The peak day represents a 50 percent increase over the average day in connection with outbound iron and steel shipments, reflecting the traditional light shipping activity on Saturdays and Mondays. All other inbound and outbound shipments have been increased by up to 25 percent to obtain peak day traffic, based on more uniform shipping patterns. An estimate of nighttime truck traffic during Step II peak day operations is presented in Table 4-222. These estimates are necessary in order to calculate probable nighttime noise impacts which are more critical than daytime impacts. The actual number of trucks expected to transit the property would be twice the numbers shown in the table since it is assumed no trucks will have a return load. A summary of two-way highway traffic at the proposed lakefront site is presented in Table 4-223.

Highway Transportation Impact Analysis

4.393
The construction and operation of the proposed plant will have a direct impact on the Regional Study Area highway network. To evaluate these effects, plant-related traffic was added to baseline traffic and network patterns. Traffic flows were then considered using two proposed plant access schemes: the Route 20 bypass and direct access from Interstate 90. The applicant has selected the I-90 access plan as the preferred action while the Route 20 option is discussed as an alternative in Chapter 6 of this statement. Three

Table 4- 220

Estimated Lakefront Plant Annual Truck Tonnage[1] (Thousands)[2]

	Step I[3]	Step II
Outbound		
Plate	--	414
Hot rolled steel to trade	1,207	1,405
Slag	888	1,775
Rolls	5	10
Misc. bulk material (Coke, lime, scale, etc.)	220	441
Total	2,320	4,545
Inbound		
Refractures	33	66
Clay	9	18
Sand	14	27
Rolls	5	10
Lumber	5	10
Paper and fibers	1	1
Alloys, machinery, strapping	84	168
Lime, ferro-manganese, silicone, etc.	108	216
Misc. parts, pallets, etc.	1	1
Total	260	517

(1) Figures in tonnes = 1.1 ton.

(2) Rounded to the nearest 1000 tons.

(3) Step I tonnage estimated at 50% of Step II tonnages, except for outbound iron and steel.

Source: United States Steel Corporation estimates.

Table 4- 221

Estimated Number of Loaded Trucks[1] Through the Gate at the Lakefront Plant

	Step I				Step II			
	Annual	Avg. Month	Peak Month	Peak Day	Annual	Avg. Month	Peak Month	Peak Day
Outbound Pa. Gate								
Midnight-8:00 a.m.	2,660	222	266	17	5,112	426	511	32
8:00 a.m.-4:00 p.m.	6,332	528	634	40	12,177	1,015	1,218	77
4:00 p.m.-Midnight	8,992	749	899	57	17,289	1,441	1,729	109
	17,984	1,499	1,799	114	34,578	2,882	3,458	218
Ohio Gate								
Midnight-8:00 a.m.	5,498	458	530	35	10,566	881	1,057	67
8:00 a.m.-4:00 p.m.	36,875	3,073	3,688	208	72,745	6,062	7,274	410
4:00p.m.-Midnight	42,372	3,531	4,237	243	83,311	6,943	8,332	477
	84,745	7,062	8,475	486	166,622	13,886	16,663	954
Inbound Pa. Gate								
Midnight-8:00 a.m.	--	--	--	--	--	--	--	--
8:00 a.m.-4:00 p.m.	1,989	166	199	11	3,978	332	398	22
4:00 p.m.-Midnight	497	41	50	3	995	83	100	5
	2,486	207	249	14	4,973	415	498	27
Ohio Gate								
Midnight-8:00 a.m.	--	--	--	--	--	--	--	--
8:00 a.m.-4:00 p.m.	7,093	591	709	38	14,186	1,182	1,419	77
4:00 p.m.-Midnight	1,773	148	177	10	3,547	296	355	19
	8,866	739	886	48	17,733	1,478	1,774	96
Total both gates (in and out)	114,081	9,507	11,409	662	223,906	18,661	22,393	1,295

(1) Most loads will be one directional, therefore actual number of trucks transiting the plant will be double the numbers shown above.

Source: United States Steel Corporation.

Table 4- 222

Estimated Lakefront Plant Night Truck Traffic
Per Hour for a Peak Day[1]
(10 p.m. - 6 a.m.)

Outbound	10:00 p.m.-Midnight	Midnight-6:00 a.m.
PA Gate	14/hour	4/hour
Ohio Gate	60/hour	8/hour
Inbound		
PA Gate	1/hour	0
Ohio Gate	3/hour	0
Total	78/hour	12/hour

[1] Most loads will be one directional, therefore actual number of trucks transiting the plant will be double the numbers shown above.

Source: United States Steel Corporation estimates.

Table 4- 223

Estimated Lakefront Plant Two-Way Highway Traffic Summary[(1)]

Time Period	No. of Trucks[(2)] Peak Hr	Peak 8 Hrs	No. of Autos[(3)] Peak Hr	Peak 8 Hrs
Step I Construction	28 (8-4 p.m.)	220 (8-4 p.m.)	4200 (7-8 a.m.) (4-5 p.m.)	4200 (See Foot-note 3)
Step II Construction and Step I Operations	96 (4-12 p.m.)	764 (4-12 p.m.)	4448 (7-8 a.m.)	5479 (10 a.m. - 6 p.m.)
Step II Operations	152 (4-12 p.m.)	1220 (4-12 p.m.)	2942 (7-8 a.m.)	4537 (See Foot-note 3)

(1) The number of loaded trucks from Step I and Step II operations shown in Tables 4-206 and 4-207 has been doubled to obtain the actual number of trucks transiting the plant. This had already been done for construction trucks.

(2) Truck traffic during Step I construction would be more or less uniform from 8 a.m. to 4 p.m., with negligible traffic at other times. During Step II construction and Step I operations, and during Step II operations, the heaviest truck traffic would occur during the 4 p.m. to midnight shift, being more or less uniformly distributed over this period.

(3) During Step II construction and Step I operations, peak hour auto traffic would occur at 7-8 a.m. and peak 8-hour auto traffic would occur from 10 a.m. to 6 p.m. During Step II operations, peak hour auto traffic would occur at 7-8 a.m. and peak 8-hour auto traffic would occur equally during the periods 6 a.m. - 2 p.m., 2 p.m. - 10 p.m. and 3 - 11 p.m.

distinct time periods were selected for direct highway impact evaluation of lakefront plant-generated traffic. The first period selected was the year 1981, corresponding to the peak of the Step I construction activities. During this year, construction will reach a total of 10,500 not including the 1,700 permanent plant employees that would be added toward the end of this period. The second year selected for evaluation was 1985 which represents Operational Step I at the plant in combination with Construction Step II. During 1985, there will be over 5,000 permanent employees on the site along with 6,000 construction workers. The final year selected for evaluation was 1990, representing stabilized Operations Step II conditions with 8,457 operational employees, and no construction workers. It should be noted that 1981 and 1985 represent temporary or transient traffic conditions, whereas 1990 represents a stable traffic condition.

4.394
During 1981, traffic associated with the proposed plant would consist of automobiles being driven by construction workers and permanent U.S. Steel employees as well as construction trucks. There would be no operations trucks since there would be no steel production during 1981. It has been assumed in all cases that vehicle occupancy for construction would be 2.5 as an average while the occupancy factor for permanent workers would be 1.0. These assumptions on vehicle occupancy were based on the experience of U.S. Steel at its other plants where public transportation is not available. For 1985, there would be truck traffic associated with actual production operations in addition to the types of traffic discussed above for 1981. Finally in 1990, all construction traffic would be gone, leaving only those vehicles associated with operations.

4.395
Analysis of projected vehicle movements showed that the 7:00 a.m. to 8:00 a.m. period was the most critical for evaluation, since the traffic movement associated with the steel mill would be greatest at that time. Consequently, this time interval selected is the time period for which traffic assignments would be made and the ability of the highway network to handle the resulting traffic flows assessed. Although not specifically examined here, traffic flows in the mid to late afternoon period would exhibit very similar characteristics to those of the 7:00 a.m. to 8:00 a.m. period. For the peak afternoon period, baseline traffic would be somewhat greater than morning peak baseline traffic while the contribution of lakefront plant-related traffic would be somewhat less. The existing highway network was defined as the numbered highway routes in the vicinity of the project including U.S. Route 20, Interstate Route 90, U.S. Route 6N, and Ohio State Route 7. Minor roadways, such as local town streets, were not included in the network due to their multiplicity and the minimal volumes that they could be expected to handle.

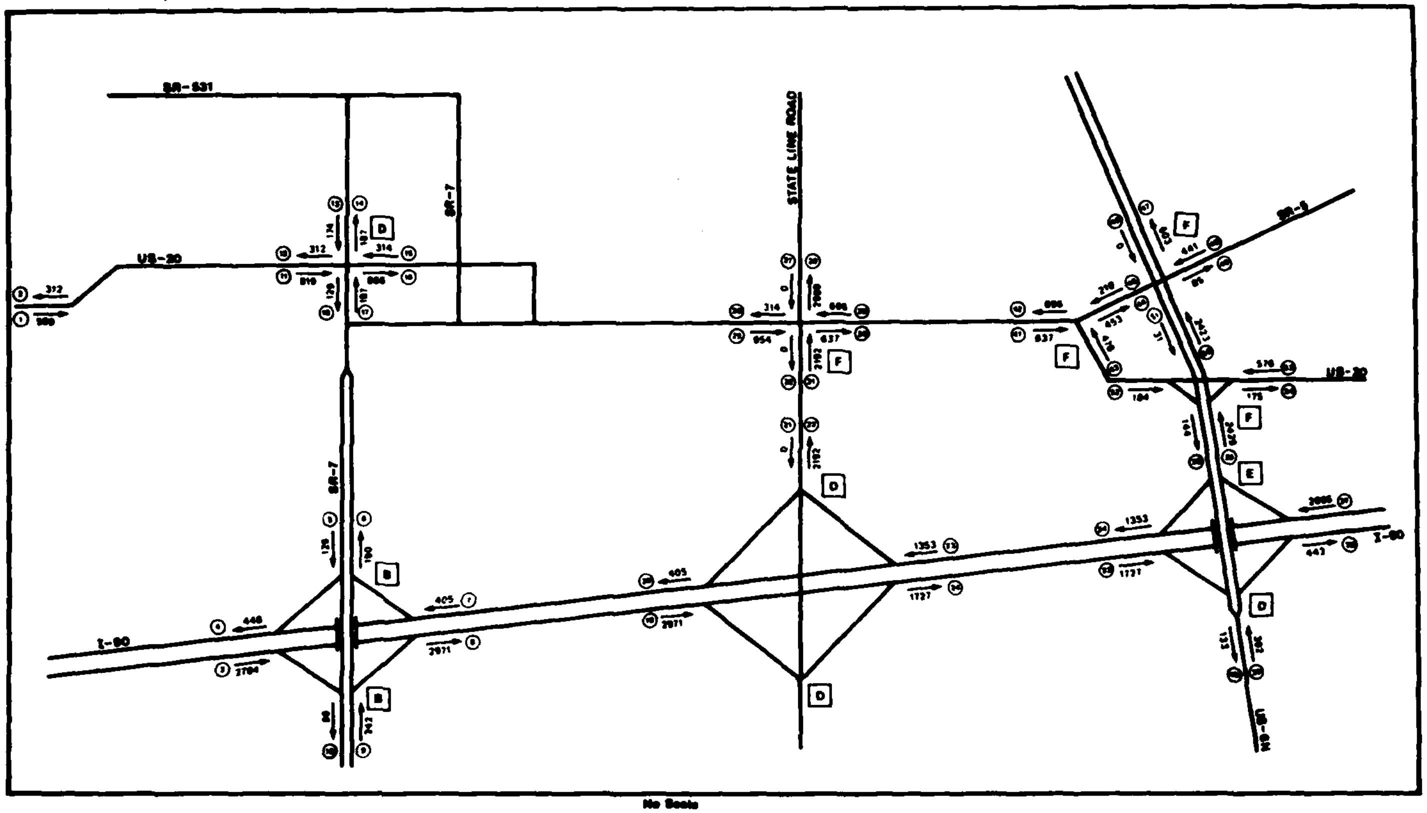
4.396
An additional requirement before any evaluations could begin was to predict baseline traffic on this same network for the 7:00 a.m. to 8:00 a.m. period in the three years under discussion. This baseline traffic was estimated using data supplied by the Ohio Department of Transportation and the Pennsylvania Department of Transportation. Such data included projected Average Annual Daily Traffic (AADT) and turning movement counts at selected intersections. Additionally, for several key locations where no existing traffic data were available, estimates of flows were made. The baseline traffic must be added to the traffic generated by the proposed plant to get total traffic on the network, at which point this total traffic can be compared with the ability of the roadway link or intersection to handle it. Such comparisons are generally called volume-to-capacity ratio determinations, from which traffic levels of service, discussed in the Highway Transportation Baseline Section of Chapter 2, can be computed.

4.397
Plant-related traffic for the 7:00 a.m. to 8:00 a.m. period for each of the three study periods was added on to the network using hypothesized routes between origin and destination. For example, all people traveling between the town of Pierpont, OH, and the lakefront plant were assumed to use Ohio State Route 7. Similarly, people from Albion, PA, were assumed to use U.S. Route 6N. In cases where more than one reasonable travel path was available, traffic was divided equally among the possible paths. Routes utilized by plant-related traffic in the immediate vicinity of the site varied for each of the alternative access/egress arrangements considered. For all traffic assignments, the residence locations of all workers both permanent and construction (including the movers and weeklies), were taken from information developed by the applicant's consultant for the 11 areas of analysis within the Principal Study Area. The remainder of the Principal Study Area in each State (excluding the coastal communities) required separate assumptions regarding the distribution of trips within these areas. Assumptions for trips with origins or destinations beyond the coastal communities also were made with regard to routes traveled. Traffic assignments for the 7:00 a.m. to 8:00 a.m. period in 1981, 1985, and 1990 were also performed for a limited network covering the Principal Study Area of the proposed plant. The additional volumes which would be added to these network roadways are generally minor. However, on some sections of major area roadways (Interstate Route 90 and U.S. Route 20) traffic will increase substantially. These roads have the capacity to carry the additional traffic. Most of the minor numbered routes would experience an increase in volume during the 7:00 a.m. to 8:00 a.m. analysis hour of 50 vehicles or less. These roadways have the capability to readily accommodate this additional load.

4.398
The applicant's preferred action for delivering and dispersing traffic to and from the U.S. Steel site is a new interchange on Interstate Route 90 (I-90) about mid-way between the existing interchanges at Ohio State Route 7 to the west and U.S. Route 6N in Pennsylvania to the east. This would provide a direct connection between State Line Road and Interstate Route 90. Traffic flows and level-of-service conditions which would result from this access/egress scheme are shown in Figures 4-38 through 4-40 for the 7:00 a.m. to 8:00 a.m. period. The traffic flows shown in these and subsequent drawings are combined flows and include baseline flow plus construction and operational vehicles and worker automobiles.

4.399
The "level of service" is a concept used to rate the ability of a facility to handle traffic. A brief description of the various levels of service and corresponding travel speeds for urban and arterial streets is shown in Table 4-224. Although not listed, speeds on major highways (such as Interstate Route 90) would be correspondingly higher. Conditions which could be expected to occur with this plan during 1981 are illustrated in Figure 4-38. Three key locations would experience level of Service F conditions, including the entrance to the steel mill at State Line Road. Levels of Service E and D would exist at five other locations including the center of Conneaut, which would be level of Service D. One of the disadvantages of this plan is that heavy traffic would pass through the Conneaut business district. A motorist approaching the steel mill site on Interstate Route 90 from Pennsylvania would have a choice of the new connection or U.S. Route 6N. For 1985, Figure 4-39 shows that there would be four key locations with level of Service F or E, including the center of Conneaut which would deteriorate from level of Service D in 1981 to level of Service F.

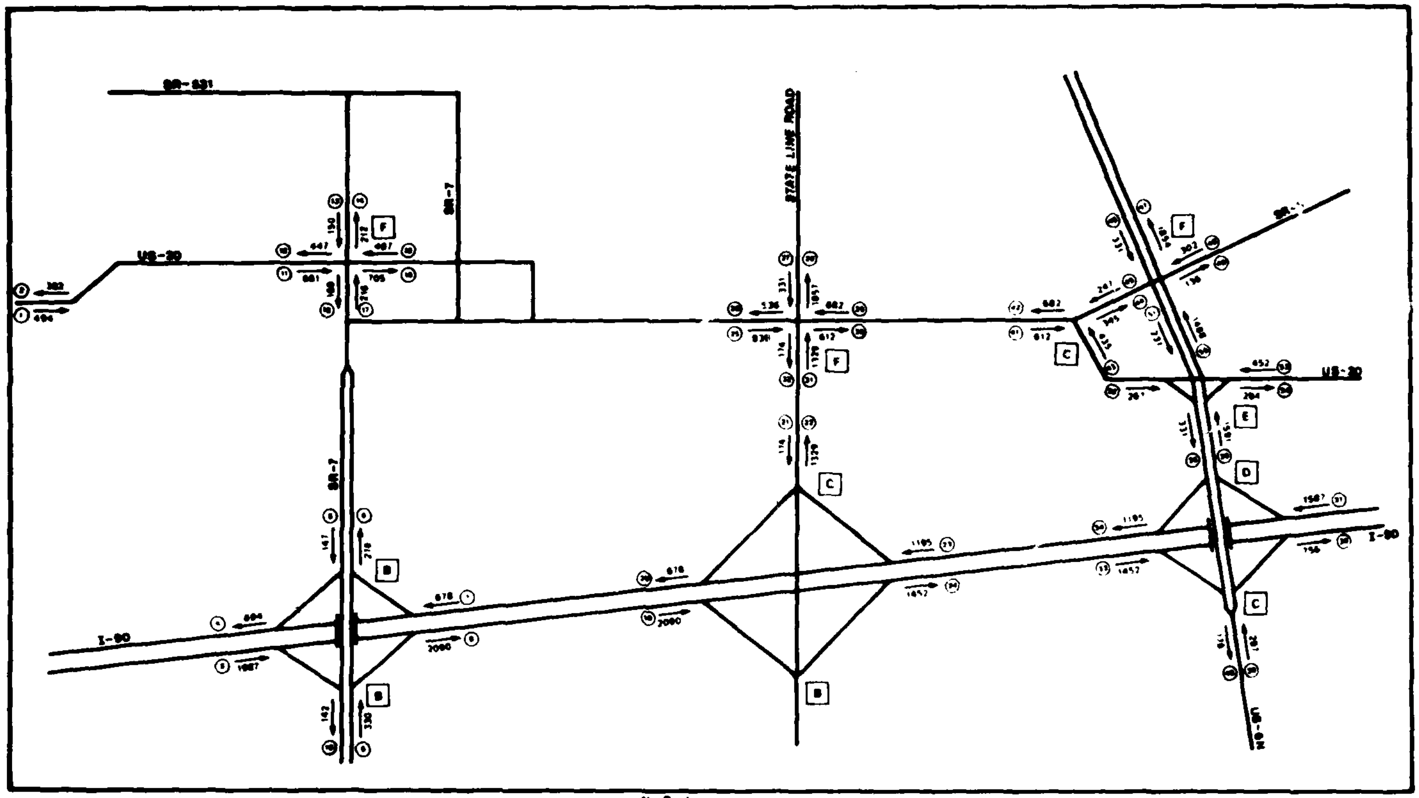
4.400
During 1990 three locations with level of Service F, including the steel mill entrances and the center of Conneaut, are projected as shown in Figure 4-40. While there are several intersections which would experience peak hour traffic problems in all three years, there are certain measures which could be instituted as standard practice to improve traffic conditions. For example, an additional travel lane could be added at key locations which could actually be physically built or could be part of a reversible lane concept whereby the number of usable travel lanes in each direction would vary according to demand (the morning rush hour might require three lanes inbound and one outbound while the evening rush hour would need three lanes outbound and one inbound). Some type of signaling system could also be employed to control the direction of travel in each lane. Such a system would be less expensive to build and maintain than additional



Legend:

- Number of Vehicles
- Appendix Table Location Reference Number
- New Roadways
- Level of Service

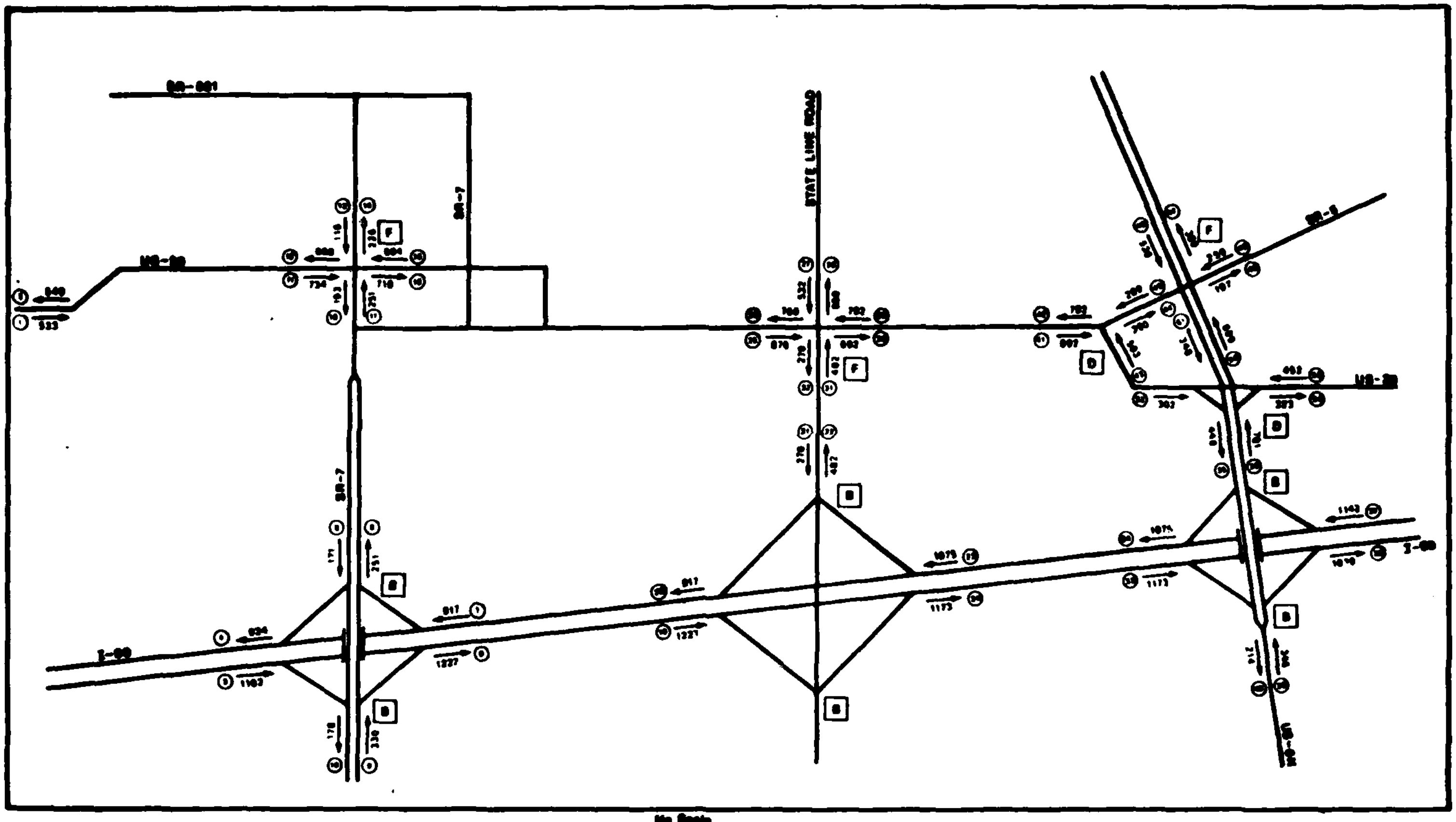
FIGURE 4–38 PROJECTED TRAFFIC FLOWS IN IMMEDIATE MILL AREA, 7–8 AM, ROUTE I–90 DIRECT ACCESS – 1981



Legend:

- Number of Vehicles
- (6) Appendix Table Location Reference Number
- New Roadways
- [F] Level of Service

FIGURE 4–39 PROJECTED TRAFFIC FLOWS IN IMMEDIATE MILL AREA 7–8 AM, ROUTE 1–90 DIRECT ACCESS – 1985



LEGEND

- Number of Vehicles
- Appendix Table Location Reference Number
- New Roadways
- Level of Service

FIGURE 4—40 PROJECTED TRAFFIC FLOWS IN IMMEDIATE MILL AREA, 7–8 AM ROUTE I—90 DIRECT ACCESS – 1990

Table 4- 224

Level of Service Description for Urban and Arterial Streets

Level of Service	Description	Average Overall Travel Speed
A	Free Flow (relatively)	≥ 30
B	Stable Flow (slight delay)	≥ 25
C	Stable Flow (acceptable delay)	≥ 20
D	Approaching Unstable Flow (tolerable delay)	≥ 15
E	Unstable Flow (congestion, intolerable delay)	~ 15
F	Forced Flow (jammed)	<15

Source: "Highway Capacity Manual"; Highway Research Board; National Academy of Sciences; National Research Council; Special Report 87, 1965.

traffic lanes. Other standard techniques which could be employed include special turning lanes and increased lane widths. Additionally, the applicant has assumed for this analysis that in 1981 all of the permanent personnel would be arriving coincidental (7:00 to 8:00 a.m.) with the construction workers. If the arrival of a portion of the permanent personnel could be delayed until after 8:00 a.m., the traffic flow situation could be improved even further. Carpooling of steel plant employees would also help to reduce traffic congestion. This access plan would experience certain problem areas in all of the years analyzed. It does have the advantage of providing Pennsylvania traffic with more than one logical interstate access point but, at the same time, does not eliminate traffic problems in the center of Conneaut. Permission would be needed from the Federal Highway Administration to waive the minimum three-mile spacing requirement between interstate highway interchanges in rural areas, since the new IR 90 interchange would be slightly less than three miles from the Ohio Route 7 and U.S. Route 6N interchanges.

Other Highway Impacts

4.401
Increased usage of roads and highways during the construction and operation of the proposed facility will require additional maintenance. The costs of such activities are difficult to predict since the need for repairs or improvements is based on traffic flow, weather conditions, and a number of other variables. In any case, communities experiencing additional traffic flows will be required to increase highway maintenance budgets by an unspecified amount.

b) Rail Transportation

4.402
Most of the construction materials, plant equipment, and construction equipment for the proposed plant would be moved by highway. However, the applicant estimates that 1.65 million tons requiring 30,000 railroad cars would move into the plant by rail. Estimating peak construction quarter rail traffic in the same manner as for trucks will require an average of about 34 rail cars or about one-third of a train per day. Coke plant by-products will be transported primarily by rail rather than by truck or barge. A breakdown of the coke plant by-products to be shipped out of the plant each year, during Step II operations, is presented in Table 4-225. Other rail shipments include inbound coal and outbound steel and slag. Rail shipments are summarized in Table 4-226 based on information provided by the applicant. The shipments itemized on Tables 4-225 and 4-226 relate to [illegible] activities. In Step I, volumes would be approximately half [illegible] are not shown. The peak frequency of all rail traffic [illegible] plant occurs in Step II operations beginning in

Table 4- 225

Annual Lakefront Plant Coke Plant
Byproducts Production -- Step II

Commodity	Tonnes Per Year Option 1	Option 2
Tar	175,000	175,000
Light Oil	40,000	40,000
Ammonia	12,800	12,800
Sulfur	7,140	0
Sulfuric Acid	0	23,500
Total	234,940	251,300

Source: United States Steel Corporation.

Table 4- 226

Estimated Lakefront Plant Annual Rail Shipments - Step II

Outbound

Commodity	Tonnes (Tons)/Year (000's)		Trains/Year[1]	Trains/Day[3]
Steel	3,509	(3,860)	450	1.44
Slag	644	(708)	83[2]	0.53[2]
By-Products	251	(276)[4]	31	0.10
Subtotal	4,404	(4,844)	564	2.07

Inbound

Commodity	Tonnes (Tons)/Year (000's)		Trains/Year	Trains/Day
Metallurgical Coal	4,800	(5,280)	550	1.76
Steam Coal	700	(770)	90	0.29
Subtotal	5,500	(6,050)	640	2.05
Total (inbound and outbound - all commodities)	9,911	(10,902)	1,204	4.12

(1) Based on an average of 78.2 tonnes (860 tons) per car and 100 cars per train.

(2) Slag is only shipped six months of the year during good weather for use in road construction.

(3) Based on a six-day week, and not counting empty trains.

(4) Tonnage for the sulfuric acid production option, Table 4-210, was chosen as the worst case or larger tonnage option.

Source: United States Steel Corporation.

1987, and has a maximum value of 8.24 trains per day, compared to projected 1990 baseline average daily traffic of 166 trains per day. The peak plant rail traffic represents an increase of 5.0 percent over projected 1990 baseline average daily traffic. Step II operations result in rail transport of 10.902 million tons per year, compared to projected 1990 baseline rail tonnage of 200 million tons per year. The plant rail tonnage represents an increase of 5.4 percent over 1990 baseline rail tonnage and is summarized in Table 4-227. The problem of trains blocking rail-highway crossings for extended periods of time can seriously hamper fire protection and medical emergency services. Additional rail traffic related to the construction and operation of the lakefront plant could aggravate this condition especially if daily rail traffic occurs when baseline rail movements are minimal. However, the plant-related increase is expected to be insignificant when compared to baseline conditions. The applicant has provided no information on potential delays associated with plant-related increases in rail traffic.

c) Water Transportation

4.403
The major water transportation requirement during the plant construction phase involves the barging of sand and gravel. The applicant estimates that 700,000 cubic yards of sand and gravel would be barged into the site for concrete foundations which is equivalent to 1,414,928 tons. Assuming the sand and gravel are barged in six-day per week during a six-month period and that the sand and gravel requirements are proportional to the Step I and Step construction budgets, 1.65 barge loads per day will be required in Step 1 and 1.10 barge loads per day in Step II. Information available to date indicates there will be no ship movements required for plant construction.

4.404
During regular plant operations, iron ore pellets and limestone will be shipped into the Port of Conneaut by lake vessel. A comparison of deep draft shipping patterns for the years 1977 and 1990 with the proposed plant in operation is presented in Table 4-228. These estimates were derived by the applicant using raw material needs for the lakefront plant and shipping data from the Pittsburgh and Conneaut Dock Company. In addition, the general decline of lake vessel traffic in the 15,400 ton range after 1980 has been considered in development of future harbor traffic trends. The small ore carriers originating from Minnesota and Wisconsin may no longer be shipping to Conneaut after 1980, and the large (49,500 tons) ore carrier originating from Minnesota, Ontario, and Labrador may increase in size to 64,900 tons. The changes in vessel sizes will substantially increase the tonnage capacity for ore and pellets. The Port of Conneaut is

Table 4- 227

Projected 1990 Lakefront Plant Rail Traffic

Baseline Rail Traffic		Plant Rail Traffic		Percent Increase due to Plant	
Average Trains/Day	Tonnes (Tons)/Year	Peak Trains/Day (1)	Tonnes (Tons)/Year	Peak Trains/Day (1)	Tonnes/Year
168	183×10^6 (201×10^6)	8.24	9.911×10^6 (10.9×10^6)	4.9	5.4

(1) Counting empty trains, i.e., each inbound and outbound loaded train counted twice. See the section entitled "Summary of Lakefront Plant Freight Traffic" presented later in this chapter.

Source: Arthur D. Little, Inc.

Table 4- 228

Projected 1990 Vessel Traffic and Existing (1977) and Projected (1990) Port Capacity

Traffic Category	Commodity: Ore and Pellets	Limestone	Coal	Total
1990 Baseline Traffic				
M Tonnes (Tons)/Year	12.90 (14.19)	2.51 (2.76)	17.67 (19.43)	33.08 (36.39)
Ships/day	1.18	0.48	2.85	4.51
1990 Plant Traffic				
M Tonnes (Tons)/Year	9.70 (10.67)	1.30 (1.43)	--	11.00 (12.1)
Ships/day	0.89	0.26	--	1.15
1990 Total Traffic				
M Tonnes (Tons)/Year	22.60 (24.86)	3.81 (4.19)	17.67 (19.44)	44.08 (48.49)
Ships/day	2.07	0.74	2.85	5.66
1977 Existing Capacity				
M Tonnes (Tons)/Year	12.0-31.0 (13.2-14.3)		12.0-13.0 (13.2-14.3)	24.0-26.0 (26.4-28.6)
Ships/day	1.71-1.85		1.94-2.10	3.65-3.95
1990 Projected Capacity				
M Tonnes (Tons)/Year	30-40 (33-44)		18 (19.8)	48-58 (52.8-63.8)
Ships/day	4-5		3	7-8

Source: United States Steel Corporation.

expected to be able to accommodate the daily passage of seven-eight lake vessels as indicated in the 1990 projections. However, the increased amount of deep draft vessel traffic may interfere with small craft movement into and out of the harbor. Similarly, the number of vessels awaiting a berth will occupy protected harbor waters which may pose a problem to small craft operators during storm periods.

d) Air Transportation

4.405
Lakefront plant impacts on the air transportation facilities in the area will not be significant. The small amount of passenger traffic generated during plant construction will not appreciably increase the baseline air traffic. Insignificant air cargo will be generated by the plant and with the exception of a few salespeople and U.S. Steel management personnel and technicians, little air passenger traffic will be generated during plant operations. Lakefront plant employees and their families will, of course, generate some air travel demand for personal and vacation travel. The air carrier airports of Cleveland and Erie have more than sufficient capacity to accommodate this increased demand which will be a tiny fraction of the demand at each airport. The main effect will be to fill some empty seats.

Energy Supply

a) Electricity

Principal Study Area

4.406
Plant-related electricity consumption in the Principal Study Area is expected to rise from roughly five million kWh in 1979 to nearly 100 million kWh in 1990. In the first three years of the study period (1979-1981), the Ohio Principal Study Area is expected to account for about one-third of the total consumption. In the last three years (1988-1990) this proportion is reversed when the Ohio Principal Study Area is expected to account for about two-thirds of the electricity consumption, while the Pennsylvania Principal Study Area is expected to account for one-third (refer to Table 4-229). In the Ohio Principal Study Area, total electricity consumption is expected to increase steadily throughout the study period and reach a maximum in 1990. In the Pennsylvania Principal Study Area, total electricity consumption is expected to reach a maximum of about 42 million kWh in 1986 -- the Step II peak year.

Table 4- 229

Secondary Electricity Demand in the Principal Study Area -- 1979-1990

	Ohio Principal Study Area		Pennsylvania Principal Study Area		Total Principal Study Area	
Year	Million kWh	Percent	Million kWh	Percent	Million kWh	Percent
1979	1.6	33%	3.2	67%	4.8	100%
1980	8.0	34	15.3	66	23.3	100
1981	19.0	36	33.7	64	52.7	100
1982	31.5	59	22.3	41	53.8	100
1983	34.6	65	19.0	35	53.6	100
1984	36.5	63	21.4	37	57.9	100
1985	41.1	58	30.0	42	71.1	100
1986	48.6	54	41.8	46	90.4	100
1987	58.1	63	34.8	37	92.9	100
1988	60.3	64	33.8	36	94.1	100
1989	60.4	64	34.1	36	94.5	100
1990	61.4	64	35.0	36	96.4	100

Note: Demand figures in millions of kWh per year. Numbers may not sum to total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

Ohio Principal Study Area

4.407
Secondary electricity consumption in the Ohio Principal Study Area is expected to rise roughly from 1.6 million kWh in 1979 to just over 60 million kWh in 1990. In the first three years of the study period (1979-1981), construction-related secondary activity should account for over 64 percent of electricity consumption. After 1981, operations-related activity is expected to account for over 86 percent of consumption. During 1979-1981, residential consumption is expected to rise from 31 percent to 66 percent of total demand. Thereafter, residential use should account for 48 percent to 58 percent of total consumption (refer to Table 4-230). Electricity consumption associated with construction-related secondary activity is expected to reach peak levels in 1980, 1981, and 1986 with approximately eight, 12, and seven million kWh, respectively. In 1979, 1982, 1984, and 1987 electricity consumption is forecast to be on the order of less than 4.5 million kWh per year. In the remaining years of the study period, electricity consumption in this category is expected to be negligible. Operation-related electricity consumption is expected to rise steadily from about seven million kWh in 1981 to over 60 million kWh in 1990.

Pennsylvania Principal Study Area

4.408
Secondary electricity consumption in the Pennsylvania Principal Study Area is expected to rise roughly from three million kWh in 1979 to about 35 million kWh in 1990. In the first three years of the study period (1979-1981) construction-related secondary activity should account for over 86 percent of electricity consumption. After 1981, operations-related secondary activity will become dominant with the exception of 1985 and 1986 when construction-related activity should account for 31 percent and 20 percent of electricity consumption, respectively. In 1979, 16 percent of consumption is expected to be residential, thereafter residential consumption should account for 29 percent to 42 percent of total demand (refer to Table 4-231). Electricity consumption associated with construction-related secondary activity is expected to reach peak levels in 1980, 1981, and 1986 with approximately 15, 29, and 18 million kWh, respectively. In the rest of the study period, construction-related secondary activity electricity demand is expected to be in the range of one to nine million kWh per year. Operations-related electricity consumption is expected to rise steadily from about five million kWh in 1981 to 35 million kWh in 1990. Total demand resulting from construction and operations-related secondary activity is expected to reach a maximum of 42 million kWh in 1986. The construction-related peak demands in 1981 and 1986 cause fluctuations in the steady growth of total electricity demand in the study period.

Table 4- 230

Secondary Electricity Demand in the Ohio Principal Study Area -- 1979-1990

	Originating Activity						Resulting Type of Demand			
	Construction		Operation		Total		Residential		Non-Residential	
Year	Million kWh	Percent	Million kWh	Percent	Million kWh	Percent	Million kWh	Percent	Million kWh	Percent
1979	1.6	100%	0.0	0%	1.6	100%	0.5	31%	1.1	69%
1980	8.0	100	0.0	0	8.0	100	4.8	60	3.2	40
1981	12.1	64	6.9	36	19.0	100	12.6	66	6.4	34
1982	2.9	9	28.6	91	31.5	100	18.2	58	13.3	42
1983	0.0	0	34.6	100	34.6	100	17.2	50	17.4	50
1984	0.5	1	36.0	99	36.5	100	18.1	50	18.3	50
1985	4.3	10	36.7	89	41.1	100	20.5	50	20.5	50
1986	7.0	14	41.6	86	48.6	100	25.9	53	22.7	47
1987	1.0	2	57.1	98	58.1	100	29.7	51	28.4	49
1988	0.0	0	60.3	100	60.3	100	29.0	48	31.3	52
1989	0.0	0	60.4	100	60.4	100	28.9	48	31.5	52
1990	0.0	0	61.4	100	61.4	100	29.7	48	31.7	52

Note: Demand figures in millions of kWh per year. Numbers may not sum to total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

Table 4- 231

Secondary Electricity Demand in the Pennsylvania Principal Study Area -- 1979-1990

	Originating Activity						Resulting Type of Demand			
	Construction		Operation		Total		Residential		Non-Residential	
Year	Million kWh	Percent	Million kWh	Percent	Million kWh	Percent	Million kWh	Percent	Million kWh	Percent
1979	3.2	100%	0.0	0%	3.2	100%	0.5	16%	2.7	84%
1980	15.3	100	0.0	0	15.3	100	4.7	31	10.6	69
1981	28.9	86	4.8	14	33.7	100	9.9	29	23.8	71
1982	5.7	26	16.6	74	22.3	100	9.2	41	13.1	59
1983	0.0	0	19.0	100	19.0	100	8.0	42	11.0	58
1984	1.4	7	19.9	93	21.4	100	8.7	41	12.6	59
1985	9.4	31	20.6	69	30.0	100	11.1	37	18.9	63
1986	18.3	20	23.5	56	41.8	100	14.2	34	27.6	66
1987	2.9	8	31.9	92	34.8	100	14.4	41	20.4	59
1988	0.0	0	33.8	100	33.8	100	14.1	42	19.6	58
1989	0.0	0	34.1	100	34.1	100	14.2	42	19.9	58
1990	0.0	0	35.0	100	35.0	100	14.7	42	20.3	58

Note: Demand figures in millions of kWh per year. Numbers may not sum to total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

Local Study Area

Ohio Local Study Area

4.409
Secondary electricity consumption in the Ohio Local Study Area is expected to rise from 0.6 million kWh in 1979 to almost 40 million in 1990. In the first three years of the study period (1979-1981), the Ohio Local Study Area is expected to account for about one-third of the total electricity consumption in the Ohio Principal Study Area; in the last three years of the study period, it should account for about 62 percent of the consumption (refer to Table 4-232). In the first three years of the study period, construction-related secondary activity is expected to account for more than 60 percent of electricity consumption. After 1981, operations-related secondary activity should account for more than 90 percent of consumption. With the exception of 1979, residential consumption is expected to account for 36 percent to 48 percent of total consumption (in 1979, it accounts for 17 percent). Commercial and industrial consumption should account for the rest (refer to Table 4-233). Construction-related secondary activity electricity consumption is expected to reach a level of over one million kWh only in the years 1980, 1981, 1985, and 1986, with consumption of 2.5, 3.8, 1.6, and 2.4 kWh, respectively.

Pennsylvania Local Study Area

4.410
Secondary electricity consumption in the Pennsylvania Local Study Area is expected to rise from less than 0.1 million kWh in 1979 to slightly over seven million in 1990. In the first three years of the study period (1979-1981), the Pennsylvania Local Study Area is expected to account for less than four percent of the total electricity consumption in the Pennsylvania Principal Study Area; in the remainder of the study period it should account for 14 percent to 21 percent of consumption, (refer to Table 4-234). Construction-related secondary activity is expected to account for more than 38 percent of electricity consumption only in 1980 and 1981. In all other years in the study period, operations-related activity is expected to account for more than 90 percent of total consumption. Residential consumption is expected to account for more than 75 percent of total consumption. Commercial and industrial consumption should account for the rest (refer to Table 4-235). Electricity consumption related to secondary construction activities is expected to reach a level of one half million kWh or under only in the years 1980, 1981, 1985, and 1986. In all the other years, construction-related secondary activity electricity consumption is expected to be negligible. Operations-related secondary activity electricity consumption should steadily increase from slightly under one million kWh in 1981 to over seven million kWh in 1990.

Table 4- 232

Secondary Electricity Demand in the
Ohio Local and Principal Study Areas -- 1979-1990

Year	Local Study Area: Million kWh	Local Study Area: Percent	Rest of Principal Study Area: Million kWh	Rest of Principal Study Area: Percent	Principal Study Area: Million kWh	Principal Study Area: Percent
1979	0.6	38%	1.0	62%	1.6	100%
1980	2.5	31	5.5	69	8.0	100
1981	6.3	33	12.7	67	19.0	100
1982	17.0	54	14.5	46	31.5	100
1983	20.7	60	13.9	40	34.6	100
1984	21.7	59	14.8	41	36.5	100
1985	23.4	57	17.7	43	41.1	100
1986	27.0	56	21.6	44	48.6	100
1987	35.4	61	22.7	39	58.1	100
1988	37.5	62	22.8	38	60.3	100
1989	37.6	62	22.8	38	60.4	100
1990	38.3	62	23.1	38	61.4	100

Note: Demand figures in millions of kWh per year. Numbers may not sum to total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

Table 4- 233

Secondary Electricity Demand in the Ohio Local Study Area -- 1979-1990

	Originating Activity						Resulting Type of Demand			
	Construction		Operation		Total		Residential		Non-Residential	
Year	Million kWh	Percent	Million kWh	Percent	Million kWh	Percent	Million kWh	Percent	Million kWh	Percent
1979	0.6	100%	0.0	0%	0.6	100%	0.1	17%	0.5	83%
1980	2.5	100	0.0	0	2.5	100	0.9	36	1.6	64
1981	3.8	60	2.5	40	6.3	100	3.0	48	3.2	52
1982	0.9	5	16.1	95	17.0	100	8.1	48	8.8	52
1983	0.0	0	20.7	100	20.7	100	8.2	40	12.6	61
1984	0.2	1	21.5	99	21.7	100	8.6	40	13.1	60
1985	1.6	7	21.8	93	23.4	100	9.2	39	14.2	61
1986	2.4	9	24.6	91	27.0	100	11.6	43	15.4	57
1987	0.4	1	35.0	99	35.4	100	15.2	43	20.3	57
1988	0.0	0	37.5	100	37.5	100	14.9	40	22.6	60
1989	0.0	0	37.6	100	37.6	100	14.9	40	22.7	60
1990	0.0	0	38.3	100	38.3	100	15.4	40	22.8	60

Note: Demand figures in millions of kWh per year. Numbers may not sum to total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

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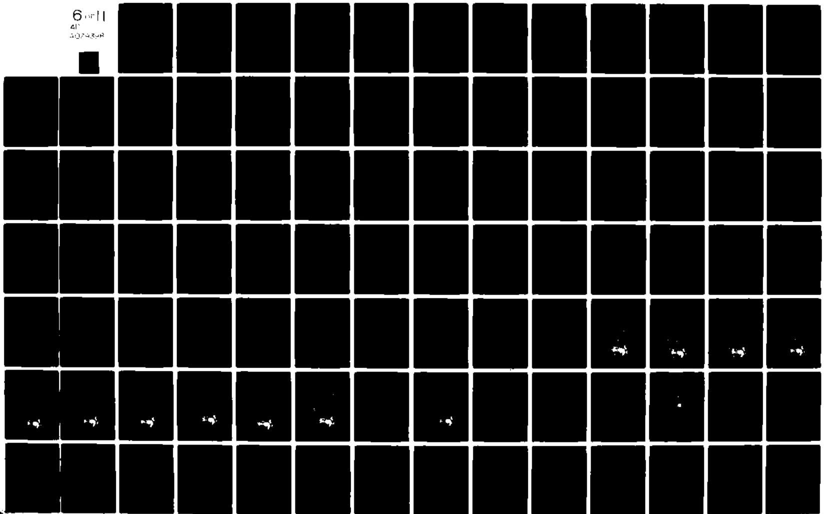


Table 4- 234

Secondary Electricity Demand in the
Pennsylvania Local and Principal Study Areas -- 1979-1990

	Local Study Area		Rest of Principal Study Area		Principal Study Area	
Year	Million kWh	Percent	Million kWh	Percent	Million kWh	Percent
1979	0.0	0%	3.2	100%	3.2	100%
1980	0.4	3	14.9	97	15.3	100
1981	1.3	4	32.4	96	33.7	100
1982	3.7	17	18.6	83	22.3	100
1983	3.9	21	15.1	79	19.0	100
1984	4.2	20	17.2	8	21.4	100
1985	4.6	15	25.4	85	30.0	100
1986	5.9	14	35.9	86	41.8	100
1987	7.2	21	27.6	79	34.8	100
1988	7.0	21	26.8	79	33.8	100
1989	7.0	21	27.1	79	34.1	100
1990	7.3	21	27.7	79	35.0	100

Note: Demand figures in millions of kWh per year. Numbers may not sum to total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

Table 4-235

Secondary Electricity Demand in the Pennsylvania Local Study Area -- 1979-1990

	Originating Activity						Resulting Type of Demand			
	Construction		Operation		Total		Residential		Non-Residential	
Year	Million kWh	Percent	Million kWh	Percent	Million kWh	Percent	Million kWh	Percent	Million kWh	Percent
1979	0.0	0%	0.0	0%	0.0	100%	0.0	0%	0.0	0%
1980	0.4	100	0.0	0	0.4	100	0.3	75	0.1	25
1981	0.5	38	0.8	62	1.3	100	1.0	77	0.3	23
1982	0.1	3	3.6	97	3.7	100	3.3	89	0.3	8
1983	0.0	0	3.9	100	3.9	100	3.5	90	0.3	8
1984	0.0	0	4.1	98	4.2	100	3.8	90	0.3	7
1985	0.2	4	4.4	96	4.6	100	4.2	91	0.4	9
1986	0.3	5	5.6	95	5.9	100	5.4	92	0.5	8
1987	0.0	0	7.1	99	7.2	100	6.6	92	0.6	8
1988	0.0	0	7.0	100	7.0	100	6.5	93	0.5	7
1989	0.0	0	7.0	100	7.0	100	6.5	93	0.5	7
1990	0.0	0	7.3	100	7.3	100	6.6	90	0.7	10

Note: Demand figures in millions of kWh per year. Numbers may not sum to total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

Impact

Ohio Study Area

4.411
Secondary electricity consumption related to the construction and operation of the proposed U.S. Steel facility over the period 1979-1990 is expected to be on the order of less than one-half of one percent of electricity demand forecast for Cleveland Electric Illuminating Company (CEI), the principal utility in the Ohio Study Area (refer to Table 4-236). Even if no baseline demand growth was experienced by CEI from 1976 to 1990, the maximum additional U.S. Steel-derived load required during the study period as a proportion of the 1976 demand would still be less than one-half of one percent. Such an order of magnitude of added load could be considered as insignificant and it is thus expected that the additional consumption will not have any appreciable effect on CEI system capacity or peak load.

Pennsylvania Study Area

4.412
Secondary electricity consumption related to the construction and operation of the proposed U.S. Steel facility over the period 1979-1990 is expected to be on the order of less than one-half of one percent of electricity demand forecast for Pennsylvania Electric Company (Penelec) the principal utility is the Pennsylvania Study Area (refer to Table 4-237). Even if no baseline demand growth was experienced by Penelec, the maximum additional U.S. Steel load required during the study period as a proportion of the 1976 Penelec demand would still be less than one-half of one percent of Penelec demand. Such an order of magnitude of added load could be considered as insignificant and it is thus expected that the additional consumption will not have any appreciable effect on Penelec system capacity or peak load.

b) Natural Gas

Principal Study Area

4.413
As a result of secondary activity derived during the construction and operation of proposed U.S. Steel plant, natural gas consumption in the Principal Study Area is expected to rise from roughly 30 million cubic feet in 1979 to nearly 900 million cubic feet in 1990. In the first three years of the study period (1979-1981), the Ohio Principal Study Area is expected to account for roughly one-third of this demand, thereafter demand is split about equally between the Ohio and Pennsylvania Study Area, with Ohio accounting for a somewhat larger

Table 4- 236

Secondary Electricity Consumption Impact for Selected Years in the Ohio Principal Study Area

	Residential			Non-Residential[1]			Total		
Year	Estimated Baseline CEIC Million kW-hrs	Secondary U.S. Steel - Related Million kWh	Impact Percent	Estimated Baseline CEIC Million kWh	Secondary U.S. Steel - Related Million kWh	Impact Percent	Estimated Baseline CEIC Million kWh	Secondary U.S. Steel - Related Million kWh	Impact Percent
1979	4621	1	0.02%	14707	1	0.00%	19328	2	0.01%
1981	5204	13	0.25	16437	6	0.04	21668	19	0.09
1986	7018	26	0.37	21821	23	0.11	28838	49	0.17
1990	8875	30	0.34	27539	32	0.12	36415	61	0.17

Note: Demand figures in millions of kWh per year. Numbers may not sum to total due to rounding.

(1) Commercial, industrial, other.

Source: Energy baseline; SIMPACT IV Model.

Table 4- 237

Secondary Electricity Consumption Impact for Selected Years in the Pennsylvania Principal Study Area

	Residential			Non-Residential (1)			Total		
Year	Estimated Baseline Penelec Million kWh	Secondary U.S. Steel - Related Million kWh	Impact Percent	Estimated Baseline Penelec Million kWh	Secondary U.S. Steel - Related Million kWh	Impact Percent	Estimated Baseline Penelec Million kWh	Secondary U.S. Steel - Related Million kWh	Impact Percent
1979	3322	1	0.03%	7431	3	0.04%	10753	3	0.03%
1981	3593	10	0.28	7901	24	0.30	11494	34	0.30
1986	4356	14	0.32	9321	28	0.30	13677	42	0.31
1990	5096	15	0.29	10951	20	0.18	16047	35	0.22

Note: Demand figures in millions of kWh per year. Numbers may not sum to total due to rounding.

(1) Commercial and industrial

Source: Energy baseline; SIMPACT IV Model.

volume (refer to Table 4-238). In the Ohio Principal Study Area, total natural gas demand is expected to steadily increase rapidly through 1987 to about 500 million cubic feet and slowly thereafter to 518 million cubic feet in 1990. In the Pennsylvania Principal Study Area, total natural gas consumption is expected to reach a maximum of about 400 million cubic feet in 1986 and slowly decline thereafter to a level of 380 million cubic feet in 1990. Construction-related secondary natural gas demand is expected to cause fluctuations in the pace and trend of the total gas demand in the study period.

Ohio Principal Study Area

4.414
Secondary natural gas consumption in the Ohio Principal Study Area is expected to rise from roughly 8.5 million cubic feet in 1979 to over 500 million cubic feet in 1990. In the first three years of the study period (1979-1981), construction-related secondary activity should account for over half of natural gas consumption. After 1981, operations-related activity accounts for the majority. Throughout the timeframe considered, residential consumption should account for 70 percent or more of total consumption (refer to Table 4-239). Construction-related secondary natural gas demand is expected to reach levels of 50-100 million cubic feet in 1980, 1981, and 1986. Gas demand of the magnitude of 20-30 million cubic feet is expected for 1982 and 1985, and of two-eight million cubic feet for 1979, 1984, and 1987. For the remaining years, construction-related secondary demand is expected to be negligible. Operations-related secondary natural gas demand is expected to rise steadily and rapidly from 1981 to 1988 from 72 to over 500 million cubic feet per year. Thereafter, the pace is expected to be significantly slower.

Pennsylvania Principal Study Area

4.415
Secondary natural gas consumption in the Pennsylvania Principal Study Area is expected to rise from roughly 19 million cubic feet in 1979 to nearly 400 million cubic feet in 1990. In the first three years of the study period (1979-1981), construction-related secondary activity should account for over three quarters of natural gas consumption. After 1981, operations-related secondary activity becomes more important and accounts for over 86 percent of consumption, with the exception of 1985 and 1986, when construction-related activity accounts for 21 percent and 31 percent, respectively, of natural gas secondary consumption. In 1979, 54 percent of consumption is expected to be residential. Thereafter, residential consumption should rise to 70 percent to 84 percent of total secondary consumption (refer to Table 4-240). Construction-related secondary activity natural gas consumption is forecast to reach levels of 100-220

Table 4-238

Secondary Natural Gas Demand in the
Principal Study Area -- 1979-1990

	Ohio Principal Study Area		Pennsylvania Principal Study Area		Total Principal Study Area	
Year	Million Cu Ft	Percent	Million Cu Ft	Percent	Million Cu Ft	Percent
1979	8.3	30%	19.1	70%	27.4	100%
1980	65.2	34	128.4	66	193.6	100
1981	174.1	38	280.5	62	454.6	100
1982	285.0	55	235.9	45	520.9	100
1983	294.4	59	208.0	41	502.4	100
1984	312.2	58	229.7	42	541.9	100
1985	347.9	54	299.7	46	647.6	100
1986	421.7	52	396.2	48	817.9	100
1987	504.5	57	378.5	43	883.0	100
1988	506.5	58	369.9	42	876.4	100
1989	506.0	58	370.4	42	876.4	100
1990	518.1	58	380.7	42	898.8	100

Note: Demand figures in millions of cubic feet per year. Numbers may not sum to total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

Table 4- 239

Secondary Natural Gas Demand in the Ohio Principal Study Area -- 1979-1990

	Originating Activity						Resulting Type of Demand			
	Construction		Operation		Total		Residential		Non-Residential	
Year	Million Cu Ft	Percent	Million Cu Ft	Percent	Million Cu Ft	Percent	Million Cu Ft	Percent	Million Cu Ft	Percent
1979	8.3	100%	0.0	0%	8.3	100%	5.8	70%	2.4	29%
1980	65.2	100	0.0	0	65.2	100	58.0	89	7.2	11
1981	101.7	58	72.4	42	174.1	100	159.8	92	14.3	8
1982	20.6	7	264.4	93	285.0	100	245.6	86	39.3	14
1983	0.0	0	294.4	100	294.4	100	239.0	81	55.3	19
1984	2.8	1	309.4	99	312.2	100	254.0	81	58.2	19
1985	28.1	8	319.8	92	347.9	100	284.5	82	63.3	18
1986	52.1	12	369.6	88	421.7	100	353.2	84	68.5	16
1987	6.7	1	497.8	99	504.5	100	414.5	82	90.0	18
1988	0.0	0	506.5	100	506.5	100	405.8	80	100.7	20
1989	0.0	0	506.0	100	506.0	100	404.8	80	101.2	20
1990	0.0	0	518.1	100	518.1	100	416.4	80	106.7	21

Note: Demand figures in millions of cubic feet per year. Numbers may not sum to the total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

Table 4- 240

Secondary Natural Gas Demand in the Pennsylvania Principal Study Area -- 1979-1990

	Originating Activity						Resulting Type of Demand			
	Construction		Operation		Total		Residential		Non-Residential	
Year	Million Cu Ft	Percent	Million Cu Ft	Percent	Million Cu Ft	Percent	Million Cu Ft	Percent	Million Cu Ft	Percent
1979	19.1	100%	0.0	0%	19.1	100%	10.3	54%	8.8	46%
1980	128.4	100	0.0	0	128.4	100	91.7	71	36.7	29
1981	220.9	79	59.6	21	280.5	100	197.0	70	83.5	30
1982	45.7	19	190.2	81	235.9	100	196.2	83	39.7	17
1983	0.0	0	208.0	100	208.0	100	175.4	84	32.6	16
1984	6.9	3	222.7	97	229.7	100	191.3	83	38.4	17
1985	63.2	21	236.5	79	299.7	100	239.8	80	59.9	20
1986	122.8	31	273.4	69	396.2	100	305.2	77	90.9	23
1987	16.6	4	361.9	96	378.5	100	315.7	83	62.8	17
1988	0.0	0	368.9	100	368.9	100	309.6	84	53.9	16
1989	0.0	0	370.4	100	370.4	100	310.4	84	60.0	16
1990	0.0	0	380.7	100	380.7	100	319.1	84	61.6	16

Note: Demand figures in millions of cubic feet per year. Numbers may not sum to the total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

million cubic feet per year in 1980, 1981, and 1986; 40-60 million cubic feet in 1982 and 1987; and 15-20 in 1979 and 1987. In the remaining years of the study period, demand is expected to be negligible. Operations-related secondary natural gas consumption is expected to double between 1982 and 1990 from 190-380 million cubic feet per year. Demand for 1981 is estimated at about 60 million cubic feet/ Total natural gas demand resulting from construction and operations-related secondary activity is expected to reach a maximum of nearly 400 million cubic feet in 1986. Thereafter, demand drops to about 380 million cubic feet for 1990. The uneven growth pattern of total demand is due to construction-related demand peaks.

Local Study Area

Ohio Local Study Area

4.416
Secondary natural gas consumption in the Conneaut Local Study Area is expected to rise from roughly two million cubic feet in 1979 to slightly over 300 million in 1990. In the first three years of the study period (1979-1981), consumption in the Ohio Local Study Area is projected to account for almost one-third of the Ohio Principal Study Area; in the following years of the study period, the Ohio Local Study Area should account for about 55 percent of the consumption (refer to Table 4-241). In the first three years of the study period, construction-related secondary activity is expected to account for most of secondary natural gas consumption. After 1981, operations-related secondary activity should account for more than 90 percent of consumption. With the exception of 1979, residential consumption is estimated to account for 75 percent to 88 percent of total consumption (in 1979, it accounts for 50 percent). Commercial and industrial consumption should account for the rest (refer to Table 4-242). Construction-related secondary natural gas demand is expected to reach a level of 14-26 million cubic feet in 1980, 1981, and 1986. For the remaining years, construction-related natural gas demand is forecast at less than eight million cubic feet per year. Operations-related secondary activity natural gas consumption is expected to double in a period of eight years -- from about 142 million cubic feet in 1982 to about 300 in 1990. A level of only 25 million cubic feet is expected in 1981.

Pennsylvania Local Study Area

4.417
Secondary natural gas consumption in the Pennsylvania Local Study Area is expected to rise from a negligible amount in 1979 to nearly 160 million cubic feet in 1990. In the first three years of the study period (1979-1981), the Pennsylvania Local Study Area should

Table 4- 241

Secondary Natural Gas Demand in the
Ohio Local and Principal Study Areas -- 1979-1990

Year	Local Study Area Million Cu Ft	Local Study Area Percent	Rest of Principal Study Area Million Cu Ft	Rest of Principal Study Area Percent	Principal Study Area Million Cu Ft	Principal Study Area Percent
1979	2.2	27%	6.1	73%	8.3	100%
1980	16.7	26	48.5	74	65.2	100
1981	51.6	30	122.5	70	174.1	100
1982	147.7	52	137.3	48	285.0	100
1983	161.7	55	132.7	45	294.4	100
1984	170.0	54	142.2	46	312.2	100
1985	181.5	52	166.4	48	347.9	100
1986	219.8	52	201.9	48	421.7	100
1987	290.8	58	213.7	42	504.5	100
1988	295.1	58	211.4	42	506.5	100
1989	295.7	58	210.3	42	506.0	100
1990	303.4	59	214.7	41	518.1	100

Note: Demand figures in millions of cubic feet per year. Numbers may not sum to total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

Table 4- 242

Secondary Natural Gas Demand in the Ohio Local Study Area -- 1979-1990

	Originating Activity						Resulting Type of Demand			
	Construction		Operation		Total		Residential		Non-Residential	
Year	Million Cu Ft	Percent	Million Cu Ft	Percent	Million Cu Ft	Percent	Million Cu Ft	Percent	Million Cu Ft	Percent
1979	2.2	100%	0.0	0%	2.2	100%	1.1	50%	1.0	45%
1980	16.7	100	0.0	0	16.7	100	13.6	81	3.1	19
1981	26.4	51	25.3	49	51.6	100	45.4	88	6.3	12
1982	6.1	4	141.6	96	147.7	100	121.4	82	26.3	18
1983	0.0	0	161.7	100	161.7	100	121.5	75	40.1	25
1984	1.1	1	168.9	99	170.0	100	128.0	75	42.0	25
1985	8.0	4	173.5	96	181.5	100	137.4	76	44.1	24
1986	14.0	6	205.8	94	219.8	100	173.0	79	46.8	21
1987	2.6	1	287.7	99	290.3	100	225.6	78	64.7	22
1988	0.0	0	295.1	100	295.1	100	221.7	75	73.3	25
1989	0.0	0	295.7	100	295.7	100	222.2	75	73.5	25
1990	0.0	0	303.4	100	303.4	100	229.6	76	73.8	24

Note: Demand figures in millions of cubic feet per year. Numbers may not sum to the total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

account for less than nine percent of the total natural gas consumption in the Pennsylvania Principal Study Area, in the remainder of the study period, it should account for 32 percent to 42 percent of the consumption (refer to Table 4-243). Construction-related secondary activity is expected to account for more than 30 percent of natural gas consumption in the first three years of the study period (1979-1981), in all other years, operations-related activity should account for more than 97 percent of consumption. Residential consumption is expected to account for more than 95 percent of total consumption (except in 1979) (refer to Table 4-244). Construction-related secondary natural gas consumption is expected to reach peak levels of seven to eight million cubic feet in 1980 and 1981. Lower peak levels of 2-3.5 million cubic feet are expected to be reached in 1982, 1985, and 1986. For the remaining years construction-related secondary gas consumption is expected to be less than one-half million cubic feet per year. Operations-related secondary activity natural gas demand is expected to double between 1982 and 1990 from about 80 to 160 million cubic feet per year. In 1981 it is estimated at somewhat over 17 million cubic feet.

Impact

Ohio Study Area

4.418
Secondary natural gas consumption related to the construction and operation of the proposed facility over the period 1979-1990 is expected to be on the order of less than one-half of one percent of baseline natural gas demand and forecast for East Ohio Gas Company (EOG), the principal utility in the Ohio Study Area (refer to Table 4-245). Even if no baseline demand growth were experienced from 1976 to 1990, the additional U.S. Steel related load required in 1990 as a proportion of the 1976 EOG demand would still be less than one-half of one percent. Such an order of magnitude of added load would appear to be insignificant, and it is thus expected that the additional consumption would not have any appreciable effect on EOG system capacity or peak load.

Pennsylvania Study Area

4.419
Secondary natural gas consumption related to the construction and operation of the proposed U.S. Steel facility over the period 1979-1990 is estimated to be on the order of less than one-half of one percent of the natural gas demand expected for National Fuel Gas Company (NFG) (refer to Table 4-246). Even if no baseline demand growth was experienced from 1976 to 1990 by NFG, the additional U.S. Steel-related load required in the peak year, 1986, as a proportion

Table 4- 243

Secondary Natural Gas Demand in the
Pennsylvania Local and Principal Study Areas -- 1979-1990

	Local Study Area		Rest of Principal Study Area		Principal Study Area	
Year	Million Cu Ft	Percent	Million Cu Ft	Percent	Million Cu Ft	Percent
1979	0.1	1%	19.0	99%	19.1	100%
1980	7.3	6	121.1	94	128.4	100
1981	25.4	9	255.1	91	280.5	100
1982	80.0	34	155.9	66	235.9	100
1983	84.4	41	123.6	59	208.0	100
1984	91.0	40	138.7	60	229.7	100
1985	99.6	33	200.1	67	299.7	100
1986	128.0	32	268.2	68	396.2	100
1987	157.2	42	221.3	58	378.5	100
1988	154.8	42	215.1	58	369.9	100
1989	154.9	42	215.5	58	370.4	100
1990	158.8	42	221.9	58	380.7	100

Note: Demand figures in millions of cubic feet per year. Numbers may not sum to total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

Table 4- 244

Secondary Natural Gas Demand in the Pennsylvania Local Study Area -- 1979-1990

	Originating Activity						Resulting Type of Demand			
	Construction		Operation		Total		Residential		Non-Residential	
Year	Million Cu Ft	Percent	Million Cu Ft	Percent	Million Cu Ft	Percent	Million Cu Ft	Percent	Million Cu Ft	Percent
1979	0.1	100%	0.0	0%	0.1	100%	0.0	0%	0.1	100%
1980	7.3	100	0.0	0	7.3	100	6.9	95	0.4	5
1981	8.0	31	17.4	69	25.4	100	24.7	97	0.8	3
1982	2.1	3	78.0	98	80.0	100	79.0	99	1.1	1
1983	0.0	0	84.4	100	84.4	100	83.4	99	1.0	1
1984	0.4	0	90.6	100	91.0	100	90.0	99	1.0	1
1985	2.6	3	96.9	97	99.6	100	98.3	99	1.3	1
1986	3.5	3	124.5	97	128.0	100	126.4	99	1.6	1
1987	0.6	0	156.6	100	157.2	100	155.1	99	2.1	1
1988	0.0	0	154.8	100	154.8	100	153.1	99	1.7	1
1989	0.0	0	154.9	100	154.9	100	153.1	99	1.7	1
1990	0.0	0	158.8	100	158.8	100	156.3	98	2.5	2

Note: Demand figures in millions of cubic feet per year. Numbers may not sum to the total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

Table 4- 245

Secondary Natural Gas Consumption Impact for Selected Years in the Ohio Principal Study Area

	Residential			Non-Residential[1]			Total		
Year	Estimated Baseline EOG Million Cu Ft	Secondary U.S. Steel - Related Million Cu Ft	Impact Percent	Estimated Baseline EOG Million Cu Ft	Secondary U.S. Steel - Related Million Cu Ft	Impact Percent	Estimated Baseline EOG Million Cu Ft	Secondary U.S. Steel - Related Million Cu Ft	Impact Percent
1979	196,180	6	0 %	208,557	2	0 %	404,737	8	0 %
1981	208,127	160	0.08	221,259	14	0	429,386	174	0.04
1986	241,276	353	0.15	256,499	69	0.03	497,775	422	0.08
1990	263,648	416	0.16	288,692	107	2.04	522,339	518	0.09

Note: Demand figures in millions of cubic feet per year. Numbers may not sum to the total due to rounding.

(1) Commercial, industrial.

Source: Energy baseline; SIMPACT IV Model.

Table 4- 246

Secondary Natural Gas Consumption Impact for Selected Years in the Pennsylvania Principal Study Area

	Residential			Non-Residential[1]			Total		
Year	Estimated Baseline Penna NFG Million Cu Ft	Secondary U.S. Steel - Related Million Cu Ft	Impact Percent	Estimated Baseline Penna NFG Million Cu Ft	Secondary U.S. Steel - Related Million Cu Ft	Impact Percent	Estimated Baseline Penna NFG Million Cu Ft	Secondary U.S. Steel - Related Million Cu Ft	Impact Percent
1979	32,200	10	0.03%	42,800	9	0.02%	75,000	19%	0.03%
1981	33,500	197	0.59	44,529	84	0.19	78,029	281	0.36
1986	36,986	305	0.82	49,163	91	0.19	86,149	396	0.46
1990	40,034	319	0.80	53,215	62	0.12	93,289	381	0.41

Year	Estimated Baseline NFG Total Million Cu Ft	Secondary U.S. Steel - Related Million Cu Ft	Impact Percent	Estimated Baseline NFG Total Million Cu Ft	Secondary U.S. Steel - Related Million Cu Ft	Impact Percent	Estimated Baseline NFG Total Million Cu Ft	Secondary U.S. Steel - Related Million Cu Ft	Impact Percent
1979	117,302	10	0%	112,236	9	0%	229,538	19	0%
1981	124,445	197	0.16	119,071	84	0.07	243,516	281	0.12
1986	144,265	305	0.21	138,035	91	0.07	282,300	396	0.14
1990	162,371	319	0.20	161,481	62	0.04	323,852	381	0.12

Note: Demand figures in millions of cubic feet per year. Numbers may not sum to the total due to rounding.

(1)Commercial and industrial

Source: Energy baseline; SIMPACT IV Model.

of the 1976 demand would still be less than one-half of one percent. Such an order of magnitude of added load could be considered as insignificant, and it is thus estimated that the additional consumption would not have any significant effect on NFG system capacity or peak load.

c) Distillate Oil

Principal Study Area

4.420
Secondary distillate oil consumption in the Principal Study Area is expected to rise from less than 700 barrels in 1979 to over 25,000 barrels in 1990. In the first three years of the study period (1979-1981), the Ohio Principal Study Area is expected to account for up to two-thirds of total consumption, thereafter the Ohio Principal Study Area should account for about 82 percent of the distillate oil consumption, while the Pennsylvania Principal Study Area should drop to about 18 percent (refer to Table 4-247).

Ohio Principal Study Area

4.421
Secondary distillate oil consumption in the Ohio Principal Study Area is expected to rise from about 400 barrels in 1979 to about 22,000 barrels in 1990. In the first three years of the study period (1979-1981), construction-related secondary activity should account for 62 percent to 100 percent of distillate oil consumption. After 1981, operations-related secondary activity is expected to account for over 85 percent of consumption. In 1979, 75 percent of expected secondary consumption is residential; thereafter 95 percent or more of consumption is residential (refer to Table 4-248).

Pennsylvania Principal Study Area

4.422
Secondary distillate oil consumption in the Pennsylvania Principal Study Area is expected to rise from about 300 barrels in 1979 to about 5,000 barrels in 1990. In the first three years of the study period (1979-1981) construction-related secondary activity should account for over 82 percent of distillate oil consumption. After 1981, operations-related activity should account for over 95 percent of consumption, with the exception of 1982, 1985, and 1986 when construction-related activity is expected to account for 25 percent, 28 percent, and 38 percent of distillate oil consumption, respectively. In 1979, two-thirds of consumption is residential. Thereafter, residential consumption accounts for 81 percent to 85 percent of total consumption (refer to Table 4-249).

Table 4- 247

Secondary Oil Demand in the Principal Study Area -- 1979-1990

	Ohio Principal Study Area		Pennsylvania Principal Study Area		Total Principal Study Area	
Year	Thousand Barrels	Percent	Thousand Barrels	Percent	Thousand Barrels	Percent
1979	0.4	57%	0.3	43%	0.7	100%
1980	3.4	60	2.3	40	5.7	100
1981	8.7	66	4.4	34	13.1	100
1982	13.2	80	3.2	20	16.4	100
1983	12.3	83	2.5	17	14.8	100
1984	12.9	83	2.7	17	15.6	100
1985	14.5	80	3.6	20	18.1	100
1986	18.8	80	4.8	20	23.6	100
1987	21.6	83	4.3	17	25.9	100
1988	21.1	83	4.3	17	25.4	100
1989	21.1	83	4.4	17	25.5	100
1990	21.7	83	4.6	17	26.3	100

Note: Demand figures in thousands of barrels per year. Numbers may not sum to total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

Table 4- 243

Secondary Oil Demand in the Ohio Principal Study Area -- 1979-1990

	Originating Activity						Resulting Type of Demand			
	Construction		Operation		Total		Residential		Non-Residential	
Year	Thousand Barrels	Percent	Thousand Barrels	Percent	Thousand Barrels	Percent	Thousand Barrels	Percent	Thousand Barrels	Percent
1979	0.4	100%	0.0	0%	0.4	100%	0.3	75%	0.1	25%
1980	3.4	100	0.0	0	3.4	100	3.3	97	0.1	3
1981	5.4	62	3.3	38	8.7	100	8.5	98	0.2	2
1982	1.4	11	11.8	89	13.2	100	12.7	96	0.5	4
1983	0.0	0	12.3	100	12.3	100	11.7	95	0.6	5
1984	0.1	1	12.8	99	12.9	100	12.3	95	0.6	5
1985	1.3	9	13.2	91	14.5	100	13.8	95	0.7	5
1986	2.8	15	16.0	85	18.8	100	17.9	95	0.9	5
1987	0.4	2	21.2	98	21.6	100	20.5	95	1.1	4
1988	0.0	0	21.1	100	21.1	100	20.1	95	1.0	5
1989	0.0	0	21.1	100	21.1	100	20.0	95	1.1	5
1990	0.0	0	21.7	100	21.7	100	20.6	95	1.1	5

Note: Demand figures in thousands of barrels per year. Numbers may not sum to total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

Table 4- 24?

Secondary Oil Demand in the Pennsylvania Principal Study Area -- 1979-1990

	Originating Activity						Resulting Type of Demand			
	Construction		Operation		Total		Residential		Non-Residential	
Year	Thousand Barrels	Percent	Thousand Barrels	Percent	Thousand Barrels	Percent	Thousand Barrels	Percent	Thousand Barrels	Percent
1979	0.3	100%	0.0	0%	0.3	100%	0.2	67%	0.1	33%
1980	2.3	100	0.0	0	2.3	100	2.0	87	0.3	13
1981	3.6	82	0.8	18	4.4	100	3.7	84	0.7	16
1982	0.8	25	2.4	75	3.2	100	2.7	84	0.5	16
1983	0.0	0	2.5	100	2.5	100	2.1	84	0.4	16
1984	0.1	4	2.6	96	2.7	100	2.2	81	0.5	19
1985	1.0	28	2.6	72	3.6	100	3.0	83	0.6	17
1986	1.8	38	3.0	62	4.8	100	3.9	81	0.9	19
1987	0.2	5	4.1	95	4.3	100	3.6	84	0.7	16
1988	0.0	0	4.3	100	4.3	100	3.6	84	0.7	16
1989	0.0	0	4.4	100	4.4	100	3.7	84	0.7	16
1990	0.0	0	4.6	100	4.6	100	3.9	85	0.7	15

Note: Demand figures in thousands of barrels per year. Numbers may not sum to total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

Local Study Area

Ohio Local Study Area

4.423
Secondary distillate oil consumption in the Ohio Local Study Area is expected to rise from a negligible amount in 1979 to over 13,000 barrels in 1990. In the first three years of the study period (1979-1981), the Ohio Local Study Area is expected to account for up to 30 percent of the total distillate oil consumption in the Ohio Principal Study Area, in the subsequent years of the study period, the Ohio Local Study Area should account for 53 percent to 62 percent of the consumption (refer to Table 4-250). In the first three years of the study period, construction-related secondary activity is expected to account for more than 50 percent of distillate oil consumption. After 1981, operations-related secondary activity should account for more than 94 percent of consumption. Residential consumption is expected to account for more than 94 percent of total consumption for the entire study period. Commercial and industrial consumption should account for the rest (refer to Table 4-251).

Pennsylvania Local Study Area

4.424
Secondary distillate oil consumption in the Pennsylvania Local Study Area is expected to rise from a negligible amount in 1979 to about 1,000 barrels in 1990. In the first three years of the study period (1979-1981), the Pennsylvania Local Study Area is expected to account for less than two percent of the total distillate oil consumption in the Pennsylvania Principal Study Area, in the remainder of the study period, it should account for 12 percent to 23 percent of the consumption (refer to Table 4-252). In all the years in the study period (with the exception of 1981), operations-related secondary activity should account for practically all distillate oil consumption (refer to Table 4-253).

Impact

4.425
Secondary distillate oil consumption related to the construction and operation of the proposed U.S. Steel facility over the period 1979-1990 is estimated to be on the order of less than one-half of one percent of distillate oil demand forecast for the Cleveland and Erie metropolitan area. As such, the added load would be considered insignificant, and it is thus estimated that the additional consumption will not have any significant effect on the distillate oil logistical system capacity or peak load.

Table 4- 250

Secondary Oil Demand in the Ohio Local and Principal Study Areas -- 1979-1990

	Local Study Area		Rest of Principal Study Area		Principal Study Area	
Year	Thousand Barrels	Percent	Thousand Barrels	Percent	Thousand Barrels	Percent
1979	0.1	25%	0.3	75%	0.4	100%
1980	0.8	24	2.6	76	3.4	100
1981	2.6	30	6.1	70	8.7	100
1982	7.0	53	6.2	47	13.2	100
1983	7.1	58	5.2	42	12.3	100
1984	7.5	58	5.4	42	12.9	100
1985	8.1	56	6.4	44	14.5	100
1986	10.1	54	8.7	46	18.8	100
1987	13.1	61	8.5	39	21.6	100
1988	13.0	62	8.1	38	21.1	100
1989	13.0	62	8.1	38	21.1	100
1990	13.4	62	8.3	38	21.7	100

Note: Demand figures in thousands of barrels per year. Numbers may not sum to total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

Table 4- 251

Secondary Oil Demand in the Ohio Local Study Area -- 1979-1990

	Originating Activity						Resulting Type of Demand			
	Construction		Operation		Total		Residential		Non-Residential	
Year	Thousand Barrels	Percent	Thousand Barrels	Percent	Thousand Barrels	Percent	Thousand Barrels	Percent	Thousand Barrels	Percent
1979	0.1	100%	0.0	0%	0.1	100%	0.1	100%	0.0	0%
1980	0.8	100	0.0	0	0.8	100	0.8	100	0.0	0
1981	1.3	50	1.3	50	2.6	100	2.5	96	0.1	4
1982	0.3	4	6.7	96	7.0	100	6.7	96	0.3	4
1983	0.0	0	7.1	100	7.1	100	6.7	94	0.4	6
1984	0.0	0	7.5	100	7.5	100	7.1	95	0.4	5
1985	0.4	5	7.7	95	8.1	100	7.6	94	0.5	6
1986	0.6	6	9.4	94	10.1	100	9.6	95	0.5	5
1987	0.1	1	13.0	99	13.1	100	12.4	95	0.7	5
1988	0.0	0	13.0	100	13.0	100	12.2	94	0.8	6
1989	0.0	0	13.0	100	13.0	100	12.3	95	0.7	5
1990	0.0	0	13.4	100	13.4	100	12.7	95	0.7	5

Note: Demand figures in thousands of barrels per year. Numbers may not sum to total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

Table 4- 252

Secondary Oil Demand in the
Pennsylvania Local and Principal Study Areas -- 1979-1990

	Local Study Area		Rest of Principal Study Area		Principal Study Area	
Year	Thousand Barrels	Percent	Thousand Barrels	Percent	Thousand Barrels	Percent
1979	0.0	0%	0.3	100%	0.3	100%
1980	0.0	0	2.3	100	2.3	100
1981	0.2	2	4.2	98	4.4	100
1982	0.5	16	2.7	84	3.2	100
1983	0.5	20	2.0	80	2.5	100
1984	0.5	19	2.2	81	2.7	100
1985	0.6	17	3.0	83	3.6	100
1986	0.6	12	4.2	88	4.8	100
1987	0.8	19	3.5	81	4.3	100
1988	1.0	23	3.3	77	4.3	100
1989	1.0	23	3.4	77	4.4	100
1990	1.0	22	3.6	78	4.6	100

Note: Demand figures in thousands of barrels per year. Numbers may not sum to total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

Table 4- 253

Secondary Oil Demand in the Pennsylvania Local Study Area -- 1979-1990

	Originating Activity						Resulting Type of Demand			
	Construction		Operations		Total		Residential		Non-Residential	
Year	Thousand Barrels	Percent	Thousand Barrels	Percent	Thousand Barrels	Percent	Thousand Barrels	Percent	Thousand Barrels	Percent
1979	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
1980	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
1981	0.1	50%	0.1	50%	0.2	100%	0.1	50%	0.1	50%
1982	0.0	0	0.5	100	0.5	100	0.5	100	0.0	0
1983	0.0	0	0.5	100	0.5	100	0.5	100	0.0	0
1984	0.0	0	0.6	100	0.6	100	0.6	100	0.0	0
1985	0.0	0	0.6	100	0.6	100	0.6	100	0.0	0
1986	0.0	0	0.8	100	0.8	100	0.8	100	0.0	0
1987	0.0	0	1.0	100	1.0	100	1.0	100	0.0	0
1988	0.0	0	1.0	100	1.0	100	1.0	100	0.0	0
1989	0.0	0	1.0	100	1.0	100	1.0	100	0.0	0
1990	0.0	0	1.0	100	1.0	100	1.0	100	0.0	0

Note: Demand figures in thousands of barrels per year. Numbers may not sum to total due to rounding.

Source: Energy Working Paper; SIMPACT IV Model.

Land Use

Primary Impacts at the Project Site and Immediate Environs

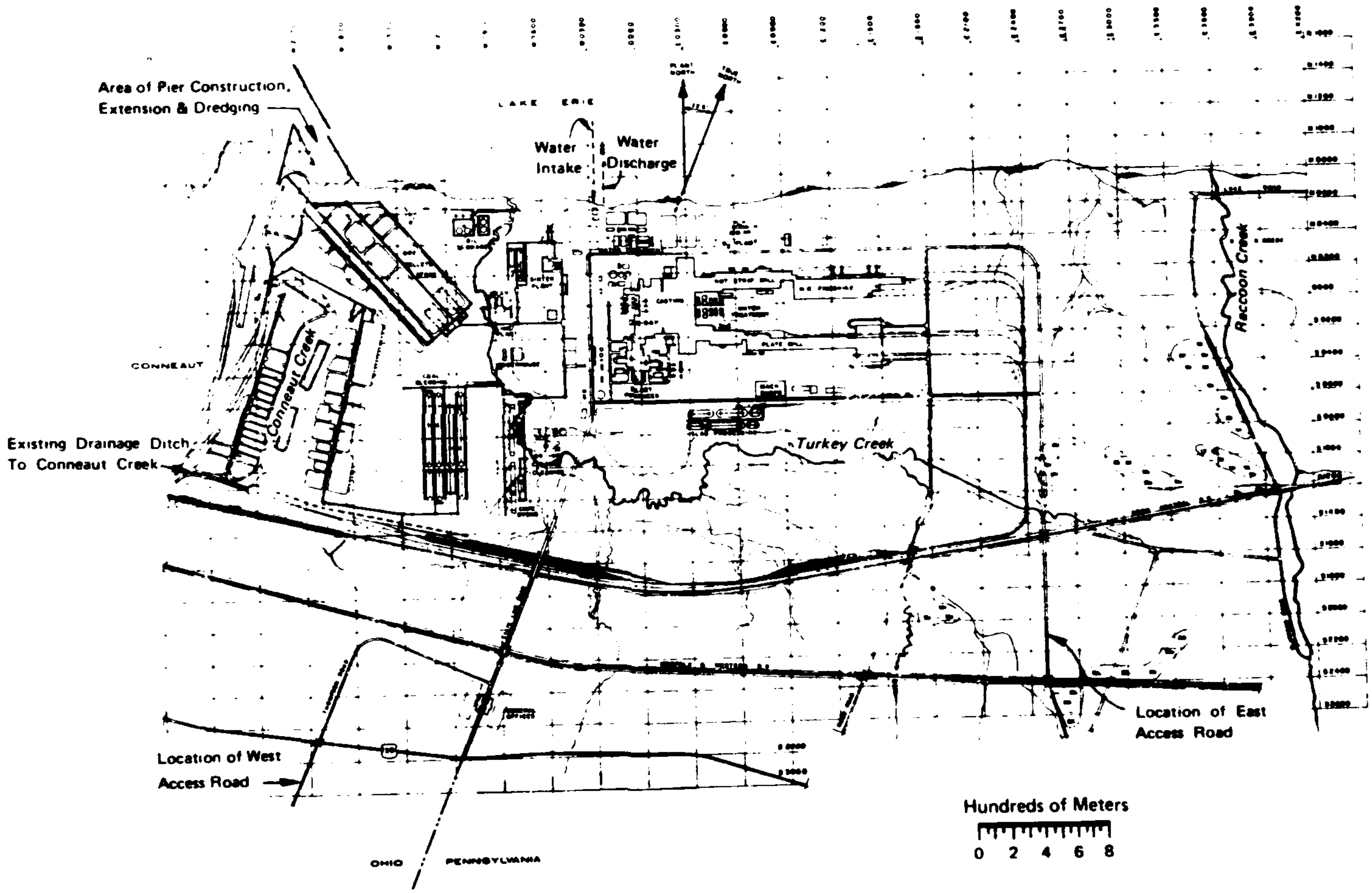
4.426
Primary land use impacts are those which are directly related to the construction and operation of the proposed facility and for the most part are under the control of the applicant.

Land Commitments at the Lakefront Site During Construction

4.427
During site preparation, approximately 1,290 acres of land will be removed. The marketable timber and rush will be chipped and sold on the open market or used for onsite erosion control. As an alternative, useable timber may be sold and the remaining surface vegetation burned. Following removal of the vegetation, all topsoil (loam) in the disturbed areas will be removed and stored for future use. Heavy equipment would then engage in cut and fill operations to achieve the desired plant elevation. Collectively, this operation would require the disturbance of approximately 1,290 acres of the proposed 2,760 acres designated for the proposed plant site. At the same time general site preparation is underway, the installation of 5,600 feet of Turkey Creek culvert would be accomplished. Approximately 7,500 feet of streambed located between Stateline Road and a point 1,500 feet upstream of Lake Erie would be replaced by the 5,600 feet of culvert. Fill operations will involve several intermittent Lake Erie tributaries. Along the lakefront, 50-60 cottages would be razed which occupy land already occupied by the applicant. In addition, public access would be terminated on Lake Road, Thompson Road, State Line Road, Childs Road, Rudd Road, and Lynch Road. There are no utilities or other major buildings on the site which would require relocation or demolition. Similarly, no agricultural lands would be destroyed or otherwise disturbed during this operation.

Operations

4.428
On completion of the construction phase, 550 acres of the 1,290 acres which are projected to be cleared and graded would be altered to impervious surface-roads, buildings, ponds, and auxiliary developed areas. The remaining 740 acres would be altered from their previous vegetation type coverage and be divided between 440 acres of slag coverage and 300 acres of seeded grasslands. No development is planned for the remaining 1,470 acres of the specified plant site. The configuration of the proposed plant can be found in Figure 4-41 while a summary of projected land use on the lakefront site is presented in Table 4-254. The buildings housing principal plant facilities would require 128 acres of land. In addition to these major



Source: United States Steel Corporation.

FIGURE 4-41 CONFIGURATION OF THE PROPOSED LAKEFRONT PLANT

Table 4-254

Projected Lakefront Plant Land Use

		Acres
Plant Buildings		
Steel Making and Mills		115
Ore Blending, Sinter and Lime Plants Powerhouse		5
Coke Ovens and By-Products		5
Water Treatment and O_2 Plants		3
Miscellaneous Developed Land		48
Total		176
Transportation Facilities		
Parking Lots		34
Rail Usage		21
Roads		76
Total		131
Auxiliary Areas		
Ponds		20
Biked Areas		131
Water Treatment		13
Coal Piles and Conveyors		50
Total		214
Slag/Grass		736
Undeveloped		1470
Total Plant Site Acreage		2727
On-Site Access Road Requirements		
Interchange at I-90	(Alternative III)	50
Connection with	(Alternatives I & III)	7
State Line Road	(Alternative II)	60
Extension of 6N	(Alternatives I, II, & III)	17.5
Rudd Road	(Alternative II)	10
General Office Facility		15
Total Related On-Site Land Use Requirement		40-100 (depends on access road alternative)

Total Primary Land Use Requirement - approximately 2800-2900 acres

Source: Unites States Steel Corporation and Arthur D. Little, Inc. estimates.

(1) Refer to Chapter 6 of this statement for a more complete discussion of alternative access roads.

plant production facilities, land use within the plant site would be allocated to various ancillary and support systems. A centrally located fire station, medical facility, warehouse facility, service shops for maintenance and repair, and wash and locker buildings are planned and would collectively occupy approximately 48 acres. A total of 214 acres would be required for settling ponds, water treatment, and solid waste treatment areas, and oil and coal storage areas. Transportation facilities would be alloted 31 acres of land including the pier extension at the dock site, roads and parking lots, and rail lines.

Impact of the Primary Land Use Requirements on the Site and Its Immediate Environs

The Project Site

4.429
A summary of the expected land use changes associated with the establishment of the proposed lakefront steel plant is presented in Table 4-255. The applicant estimates that approximately 35 percent of the site could remain in tree cover, 35 percent in shrub cover, and five percent in herb type vegetation. Overall, the number of acres developed and the type of the proposed development would change the character of the area from a combination of varied open and woodland acres to an open, heavy industrial site.

Primary Impacts of the Proposed Action on Archaeological Resources

4.430
The archaeological sites identified during the survey of the proposed Lakefront site are located in areas which are not within the regulatory jurisdiction of the Corps of Engineers under Section 10 of the River and Harbor Act of 1899 and Section 404 of the Federal Water Pollution Control Act of 1972. However, to insure full public interest review, the impact of the proposed action on archaeological resources is presented below. Five of the six "degraded and disturbed" prehistoric archaeological sites on the proposed project site (numbers 1, 5, 7, 14, and 15 (refer to Chapter Two), would not directly be disturbed by the proposed plant construction activities or by alternative plans that would relocate Turkey Creek to the east. Site 8 would also remain undisturbed by the proposed action but an easterly relocation of Turkey Creek (refer to Chapter Six) could result in the loss of what remains of the site. A seventh site, number 16, which is considered a "functional segment" of an archaeological site extending beyond the project site boundary would not be directly impacted by the proposed construction activities. Utilizing criteria for nomination to the National Register, nine

Table 4-255

Comparison of Existing and Proposed Use of the Project Site

Existing Use	Acres	%	Proposed Use-(Acres)[1]	%
Trees	2200	40%	1900	35%
Shrubs	2400	45	2000	35
Herbs	320	5	250	5
Developed or Under Construction	550	10	1305	25
Total	5470	100%	*	100%

[1] Totals do not add due to rounding.

Source: Aquatic Ecology Associates, Summary Report, July 15, 1977; U.S. Steel, proposed plant layout, 7-20-77; Arthur D. Little, Inc. estimates.

archaeological sites located within the proposed site area are considered eligible. Of these sites, 11, 12, and 13 would have been the most directly affected by the proposed action. However, the areas involved had already been disturbed or seriously degraded as a result of past construction activities and pilferage. In addition, bluff erosion threatened those archaeological remains that were still intact. Under these circumstances the applicant arranged to have these artifacts salvaged by Dr. David Brose, Cleveland Museum of Natural History during the summer of 1977. Another of the potentially eligible sites is number 6, described by the investigators as being in a location that would be difficult to excavate with present technology. This site may be in the path of the proposed access route to the facility, however, there is no way of assessing the impact on these resources since the final access road alignment has not been determined. Sites 9 and 10 would not be affected by proposed construction activities, but could be directly affected by the alternative relocation of Turkey Creek, (refer to Chapter Six of this statement). Sites 2, 3, and 4 would not be directly affected by either construction of the proposed facility or the Turkey Creek relocation alternative. The applicant's current proposal to culvert Turkey Creek would not affect any of the archeological sites identified during the survey.

Aesthetic Impacts

4.431
Although a green belt of vegetation is planned separating the proposed site from the rural residential and recreational uses to the south and east, the height of some of the process equipment would create a visual impact for residents of these areas and for the users of the park. In addition, the anticipated traffic flow to and from the plant during the construction and operations phases would create an increase in noise and activity in the rural community of West Springfield. An increase in commercial uses of lands adjacent to access areas to the plant is also anticipated. Similarly, the resultant emissions from the plant could affect the local vegetation and the desirability of using Raccoon Creek Park. On the western, boundary, the proposed facility would be less buffered by a vegetation zone, but this area is already in heavy industrial use. To the residents of eastern Conneaut, west and southwest of the plant property, the proposed facility would probably create a visual extension of the type of use represented by the existing heavy industrial facility for raw materials handling.

4.432
In terms of the prevalent meteorological conditions, exposure to plant air emissions would be less frequent to the southwest and west. However, increased traffic may create congestion and noise impacts

that would affect existing residential land use in West Springfield. The lake frontage of the site would be altered by the facility. The shoreline would change from existing bluff erosion rimmed by trees and cottages to a protected shoreline backed by an industrial facility with some units equalling the height of 30-story buildings. Pleasure boaters using Lake Erie will detect a visual change in the character of the shoreline as one of the larger remaining parcels of relatively undisturbed land on the southern boundary of the Central Basin, as developed.

Secondary Impacts

a) Secondary Land Use Requirements

4.433
Secondary impacts as they relate to land use are generally associated with new resident populations and their activities. Table 4-256 summarizes these impacts from 1979 (peak construction year) to 1990 by projecting incremental land requirements (consumption) for various land use types as they apply for each coastal community in the project area. Land use requirements were based on population projections, current land use in the communities and future reductions in per capita land use requirements. The transportation land use requirement was determined from residential use and adjusted to account for the proportion of homes which were projected to be built on existing roads versus those roads which would occur in new subdivisions. The requirement shown for Conneaut does not include the access road alternative. All other land uses were projected to be located off existing major routes. The excess capacity of existing highways, rail, water, and air transportation were estimated to be more than sufficient for the projected impact population.

4.434
The climate moderating effects of Lake Erie coupled with the high quality soils of the adjoining Lake Plain make the coastal zone of the Regional Study Area a suitable locale for the production of fruit and specialty crops. In view of the importance of this area the applicant has estimated potential losses of "prime" farmland through 1990 using the SIMPACT IV model, aerial photography, and county soil maps. The projected losses due to development are presented in Table 4-257.

4.435
This analysis is based on the worst case assumption that all of the projected growth in each community would take place on prime agricultural land rather than other types of vacant land. However, the reviewer is advised that development would actually occur in areas where the infrastructure (i.e. sewer and water lines) is already in

Table 4-256

Projected Secondary Impact-Related Land Use Requirements for the Coastal Communities (Acres)

Local Study Area	Residential(2) 1979	1982	1987	1990	Total	% of Total Requirement	Commercial 1979	1982	1987	1990	Total	% of Total Requirement
Conneaut City	2	181	143	8	334	58%	1	8	3	1	13	2%
Springfield Area	0	103	92	3	198	58	0	4	1	0	5	1
Ohio Coastal Communities												
Kingsville	10	101	34	2	147	64	0	1	0	0	1	1
Ashtabula Township	0	87	55	0	142	64	0	1	0	0	1	*
Ashtabula City	0	15	6	0	21	36	1	6	2	1	10	17
Saybrook	2	55	1	0	58	69	0	1	0	0	1	1
Pennsylvania Coastal Communities												
Girard Area	2	56	39	0	97	59	0	2	0	0	2	1
Fairview Township	8	57	12	1	78	62	0	1	0	0	1	1
Millcreek Township	7	51	14	0	72	58	0	0	0	0	0	0
Regional Study Area Ohio	19	504	258	10	791	62	2	17	5	2	26	2
Regional Study Area Pennsylvania	29	318	174	17	538	61	0	7	1	0	8	1

Local Study Area	Industrial 1979	1982	1987	1990	Total	% of Total Requirement	Institutional 1979	1982	1987	1990	Total	% of Total Requirement
Conneaut City	0	2	4	1	7	1%	0	12	19	0	31	6%
Springfield Area	0	0	0	0	0	0	0	1	6	0	7	2
Ohio Coastal Communities												
Kingsville Township	0	0	0	0	0	0	0	0	0	0	0	0
Ashtabula Township	0	0	0	0	0	0	0	0	2	0	2	1
Ashtabula City	0	0	0	0	0	0	0	0	0	0	0	0
Saybrook	0	0	0	0	0	0	0	0	0	0	0	0
Pennsylvania Coastal Communities												
Girard Area	0	0	0	0	0	0	0	0	0	0	0	0
Fairview Township	0	0	0	0	0	0	0	0	0	0	0	0
Millcreek Township	0	0	0	0	0	0	0	0	0	0	0	0
Regional Study Area Ohio	0	2	4	1	7	1	0	12	21	0	33	3
Regional Study Area Pennsylvania	1	13	0	0	14	2	0	13	7	0	20	2

Table 4-256 (Continued)

Local Study Area	Recreational 1979	1982	1987	1990	Total	% of Total Requirement	Vacant & Agricultural(3) 1979	1982	1987	1990	Total
Conneaut City	1	95	74	4	174	30	-4	-306	-249	-15	-574
Springfield Area	0	61	56	1	118	35	0	-177	-161	-4	-342
Ohio Coastal Communities											
Kingsville Township	3	48	19	1	71	30	-14	-158	-55	-3	-230
Ashtabula Township	0	35	33	0	68	31	0	-129	-93	0	-222
Ashtabula City	0	21	5	0	26	45	-1	-43	-13	-1	-58
Saybrook	1	21	0	0	22	26	-3	-80	-1	0	-84
Pennsylvania Coastal Communities											
Girard Area	1	34	23	0	58	36	-3	-96	-65	0	-164
Fairview Township	2	30	8	0	40	32	-11	-93	-21	-1	-126
Millcreek Township	2	36	8	0	46	37	-10	-92	-23	0	-125
Regional Study Area Ohio	5	220	131	5	361	28	-28	-786	-432	-19	-1265
Regional Study Area Pennsylvania	5	161	95	1	262	29	-38	-542	-289	-19	-888

Local Study Area	Transportation 1979	1982	1987	1990	Total	% of Total Requirement	Total 1979	1982	1987	1990	Total
Conneaut City	0	8	6	1	15	3	4	306	249	15	574
Springfield Area	0	8	6	0	14	4	0	177	161	4	342
Ohio Coastal Communities											
Kingsville Township	1	8	2	0	11	5	14	158	55	3	230
Ashtabula Township	0	6	3	0	9	4	0	129	93	0	222
Ashtabula City	0	1	0	0	1	2	1	43	13	1	58
Saybrook	0	3	0	0	3	3	3	80	1	0	84
Pennsylvania Coastal Communities											
Girard Area	0	4	3	0	7	4	3	96	65	0	164
Fairview Township	1	5	1	0	7	5	11	93	21	1	126
Millcreek Township	1	5	1	0	7	5	10	92	23	0	125
Regional Study Area Ohio	2	31	13	1	47	4	28	786	432	19	1265
Regional Study Area Pennsylvania	3	30	12	1	46	5	38	542	289	19	888

*Indicates less than one-half percent.

(1) Once peak land use requirements occur for any type except agricultural/rural, land use continues at this level even though predicted new requirements for land use may decline.

(2) Includes only the actual plot of land, not "common open space".

(3) Includes additional open space requirement as defined in the New Residential Housing Requirements Working Paper. Does not include requirement for the "Route 20 bypass" access alternative (see text).

Source: Arthur D. Little, Inc. estimates, based on SIMPACT IV Model.

Table 4-257

Projected Impact on Prime Agricultural Lands in the Coastal Communities

	Total Acres	Acres of Rural/ Undev. Land	Prime Agricultural Land (Acres)	Unforested Prime Agricultural Land (Acres)	Projected Baseline Land Use Requirement	Baseline + Impact Land Use Requirement	% of Prime Agricultural Land Required (Baseline)	% of Unforested Prime Agricultural Land Required (Baseline)	% of Prime Agricultural Land Required (Impact + Baseline)	% of Unforested Prime Agricultural Land Required Impact + Baseline
OHIO COASTAL COMMUNITIES										
Conneaut	16,330	12,239	6,430	4,850	160	735	2%	3%	11%	15%
Kingsville	13,878	10,797	3,845	2,955	465	690	12	16	18	23
Ashtabula Township	8,485	5,347	4,130	3,095	230	450	6	9	11	15
Ashtabula City	4,741	11,390	1,285	1,005	160	215	12	16	17	21
Saybrook	20,000	16,386	10,785	7,315	730	815	7	7	8	11
PENNSYLVANIA COASTAL COMMUNITIES										
Springfield	23,154	20,735	12,340	3,380	170	515	1	5	4	15
Girard	24,030	19,906	9,625	8,130	950	610	5	4	6	8
Fairview	18,308	13,461	10,855	9,330	505	630	5	5	6	7
Millcreek	21,614	9,405	8,705	7,230	795	915	9	11	11	13
LOCAL STUDY AREA	39,484	32,974	18,770	8,230	330	1,250	2	4	7	15
COASTAL COMMUNITIES STUDY AREA--OHIO	63,434	46,159	26,475	19,220	1,745	2,905	7	9	11	15
COASTAL COMMUNITIES STUDY AREA--PENNSYLVANIA	87,106	63,501	41,525	28,070	1,920	2,670	5	7	6	10

SOURCE: Arthur D. Little, Inc., estimates based on SIMPACT IV MODEL, County Soil Maps, and 1977 Aerial Photographs.

place or can be expanded readily to meet development needs, rather than in rural agricultural areas. The results of this investigation indicate that more than 75 percent of the unforested prime agricultural land in each community is projected to remain available in 1990. In summary, 85 percent of the unforested prime agricultural land in the Ohio Coastal Communities and 90 percent in the Pennsylvania Coastal Communities would remain undeveloped by 1990.

4.436
The Corps staff recognizes the importance of protecting and preserving productive farmlands and encourages local and regional planning entities to consider these values when planning future growth and development.

The Regional Study Area

4.437
The Ohio Regional Study Area is projected to require about 1,330 acres to absorb secondary development while the Regional Study Area in Pennsylvania is expected to require about 4,000 acres. Of these totals, residential requirements should account for about 60 percent and recreational requirements nearly 30 percent. The remaining land use types such as commercial, institutional, transportation, and industrial are presently available in excess capacity and are expected to require only minimal new acreage for expansion (refer to Table 4-256). Proportionate estimate of the decline in agricultural land versus undeveloped land have also been derived by the applicant utilizing data on land use trends and applying the assumption that openland is easier to develop than other land use types. These estimates indicate that for the Ohio Regional Study Area, approximately 700 acres of agricultural land would be developed, along with approximately 500 acres in the Pennsylvania Regional Study Area.

The Local Study Area

4.438
The communities of the Local Study Area have a substantially greater projected land use requirement than any of the remaining Coastal Communities. The projected land requirement for Conneaut would account for about 45 percent (575 acres) of the total projected secondary land use requirement in the Ohio portion of the Regional Study Area. Springfield is projected to require about 40 percent (340 acres) of Pennsylvania's projected secondary land use requirement. As for the Regional Study Area, the greatest projected land use requirement in the Local Study Area communities is for residential and recreational uses. The demand for residential land requirements is projected to be about twice as much as the projected recreational land demand. In Conneaut, about 335 acres are projected

to meet the expected in-migrant residential needs and about 175 acres of new recreational land use could be anticipated. Projections for Springfield include about 200 acres of residential land and 120 acres of recreational land. Although the proportional demands for institutional, industrial, commercial, and transportation land requirements are slightly greater in the Local Study Area communities than in the Regional Study Area as a whole, the amount of new land devoted to all of these uses except transportation is projected to be minimal.

The Coastal Communities in Ohio and Pennsylvania

4.439
In Ohio, Kingsville and Ashtabula Townships are projected to require three to four times as much land as Ashtabula City and Saybrook. Kingsville is projected to require about 230 acres, Ashtabula Township about 220 acres, Ashtabula City about 60 acres, and Saybrook about 85 acres. The basis for the somewhat uneven distribution of this projected per capita impact land requirement is the lack of available space in Ashtabula City for expansion, particularly for residential land uses. The greater travel distance from Saybrook to the proposed plant site is one of the principal factors in the expectation of relatively low population growth (and related land requirements) in that community. Secondary land use requirements are projected to be similar among the Pennsylvania communities ranging between the requirements projected for Kingsville and Ashtabula Township and that projected for Ashtabula City and Saybrook in Ohio. The communities of Girard, Fairview, and Millcreek are projected to require, respectively, about 165, 125, and 125 additional acres for the secondary impact-related activity.

b) Comparison of the Projected Impact Land Use Requirement With Projected Baseline Conditions

4.440
The Land Use baseline section of Chapter Two projects additional land usage by type for the anticipated 1990 population for each of the Coastal Communities. These estimates are based on baseline population projections and land requirement factors developed for use in the SIMPACT IV Model. These factors were used rather than the divergent State Agency projections in order to arrive at a consistent projection method. This method is based on the assumption that per capita land requirements of individuals and facilities within the baseline population would be the same as those for members of the "impact" population. The projected baseline and plant-related land use requirements for the 1979-1990 study period for the communities and the Coastal Regional Study Area are presented in Table 4-258. Table 4-259 lists the projected percentage distribution of land use,

Table 4-258

Effect of Impact Requirement on Projected Land Use Patterns -- 1979-1990 (in 1971 Acres)

Community	Land Uses	1 Baseline 1979 Acres	2 [3-1] Baseline Incremental Requirement 1979-1990	3 Baseline 1990 Acres	4 Impact Incremental Requirement 1979-1990	5 [4+3] Total & Impact Growth 1979-1990	6 [4/2] % Impact Relative To Baseline Requirement	7 [(2+4)/1] Growth in Land Use	8 [2/1] % Projected Baseline Growth	9 [4/1] % Growth Dut to Impact
Local Study Area										
Conneaut City	Residential	1,590	55	1,645	335	1,980	609%	25%	4%	21%
	Commercial	85	5	90	15	105	300	24	6	18
	Industrial	795	45	840	5	845	11	6	6	1
	Institutional	285	15	300	30	330	200	16	5	11
	Recreational	165	25	190	175	365	700	121	15	106
	Vacant/Agricultural	13,460	-160	13,300	-575	12,725	359	-5	-1	-4
	Transportation	1,165	15	1,180	15	1,195	100	3	1	1
	Developed Land	4,090	160	4,250	575	4,825	359	18	4	14
Springfield Area	Residential	985	45	1,030	200	1,230	444	25	5	20
	Commercial	40	10	50	5	55	50	38	25	13
	Industrial	30	25	55	*	55	0	83	83	0
	Institutional	465	10	475	5	480	50	3	2	1
	Recreational	25	30	55	120	175	400	600	120	480
	Vacant/Agricultural	21,100	-170	20,930	-345	20,585	203	-2	-1	-2
	Transportation	1,160	50	1,210	15	1,225	30	6	4	1
	Developed Land	2,700	170	2,870	345	3,215	203	19	6	13
Ohio Coastal Communities										
Kingsville Township	Residential	865	90	955	145	1,100	161	27	10	17
	Commercial	245	45	290	*	290	0	18	18	0
	Industrial	70	15	85	*	85	0	21	21	0
	Institutional	1,185	230	1,415	*	1,415	0	19	19	0
	Recreational	165	40	205	70	275	175	67	24	42
	Vacant/Agricultural	10,500	-465	10,035	-225	9,810	48	-7	-4	-2
	Transportation	845	45	890	10	900	22	7	5	1
	Developed Land	3,400	465	3,865	225	4,090	48	20	14	7
Ashtabula Township	Residential	1,240	50	1,290	140	1,430	280	15	4	11
	Commercial	105	10	115	*	115	0	10	10	0
	Industrial	1,040	95	1,135	0	1,135	0	9	9	0
	Institutional	560	45	605	*	605	0	8	8	0
	Recreational	5	25	30	70	100	280	1,900	500	1,400
	Vacant/Agricultural	5,315	-230	5,085	-220	4,865	96	-8	-4	-24
	Transportation	220	5	225	10	235	200	7	2	4
	Developed Land	3,185	230	3,415	220	3,635	96	14	7	7
Ashtabula City(1)	Residential	1,190	-65	1,125	20	1,145	-31	4	-5	2
	Commercial	155	-10	145	10	155	-1	0	-6	6
	Industrial	790	-65	725	0	725	0	-8	-8	0
	Institutional	290	-20	270	0	270	-8	-7	-7	0
	Recreational	155	0	155	25	180	2,500	16	0	16
	Vacant/Agricultural	1,630	160	1,790	-55	1,735	-34	6	10	-3
	Transportation	530	0	530	*	530	0	0	0	0
	Developed Land	3,120	-160	2,960	55	3,015	-34	-3	-5	2

Table 4-258 (Continued)

Community	Land Uses	1 Baseline 1979 Acres	2 [3-1] Baseline Incremental Requirement 1979-1990	3 Baseline 1990 Acres	4 Impact Incremental Requirement 1979-1990	5 [4+3] Total & Impact Growth 1979-1990	6 [4/2] % Impact Relative To Baseline Requirement	7 [(2+4)/1] % Total Growth in Land Use	8 [2/1] % Projected Baseline Growth	9 [4/1] % Growth Due to Impact
Ohio Coastal Communities (Cont.)										
Saybrook Township	Residential	1,495	140	1,635	60	1,695	43%	13%	9%	4%
	Commercial	385	85	470	*	470	0	22	22	0
	Industrial	330	90	420	0	420	0	27	27	0
	Institutional	205	310	515	0	515	0	150	151	0
	Recreational	890	65	955	20	975	31	10	7	2
	Vacant/Agricultural	16,240	-730	15,510	-85	15,425	12	-5	-4	1
	Transportation	535	40	575	5	580	12	8	8	1
	Developed Land	3,860	730	4,590	85	4,675	12	21	19	2
Pennsylvania Coastal Communities										
Girard Area	Residential	1,510	115	1,625	95	1,720	83	14	8	6
	Commercial	365	75	440	*	440	0	21	21	0
	Industrial	140	30	170	0	170	0	21	21	0
	Institutional	415	85	500	0	500	0	21	21	0
	Recreational	500	75	575	60	635	80	27	15	12
	Vacant/Agricultural	20,650	-450	20,200	-160	20,040	36	-3	-2	-1
	Transportation	1,295	70	1,365	5	1,370	7	6	5	0
	Developed Land	4,200	450	4,650	160	4,810	36	14	11	4
Fairview Township	Residential	2,010	205	2,215	80	2,295	39	14	10	4
	Commercial	165	35	200	*	200	0	21	21	0
	Industrial	60	15	75	*	75	0	25	25	0
	Institutional	425	95	520	*	520	0	22	22	0
	Recreational	160	85	245	40	285	47	78	53	25
	Vacant/Agricultural	14,440	-505	13,935	-125	13,810	25	-4	-4	-1
	Transportation	1,100	70	1,170	5	1,175	7	7	6	1
	Developed Land	3,910	505	4,415	125	4,450	25	16	13	3
Millcreek Township	Residential	4,470	330	4,800	70	4,870	21	9	7	2
	Commercial	720	90	810	*	810	0	13	13	0
	Industrial	200	25	225	*	225	0	13	13	0
	Institutional	765	90	855	*	855	0	12	12	0
	Recreational	240	190	430	45	475	24	98	79	19
	Vacant/Agricultural	10,190	-795	9,395	-120	9,275	15	-9	-8	-1
	Transportation	2,095	70	2,165	5	2,170	7	4	3	0
	Developed Land	8,510	795	9,305	120	9,425	15	11	9	1
Ohio Regional Study Area	Residential	14,885	425	15,310	790	16,100	186	8	3	5
	Commercial	1,965	115	2,080	25	2,105	22	7	6	1
	Industrial	3,415	195	3,610	5	3,615	3	6	6	0
	Institutional	9,220	525	9,745	35	9,780	7	6	6	0
	Recreational	9,390	160	9,550	360	9,910	225	6	2	4

Table 4-258 (Continued)

Community	Land Uses	1 Baseline 1979 Acres	2 [3-1] Baseline Incremental Requirement 1979-1990	3 Baseline 1990 Acres	4 Impact Incremental Requirement 1979-1990	5 [4+3] Total Impact Growth 1979-1990	6 [4/2] % Impact Relative To Baseline Requirement	7 [(2+4)/1] % Total Growth in Land Use	8 [2/1] % Projected Baseline Growth	9 [4/1] % Growth Due to Impact
Ohio Regional Study Area (Cont.)	Vacant/Agricultural	403,190	-1,680	401,510	-1,270	400,240	75%	-1%	0%	0%
	Transportation	N/A		N/A	45					
	Total Developed Acreage(2)(3)	30,865	1,420	32,285	1,215	33,500	86	2	1	1
Pennsylvania Regional Study Area	Residential	51,360	2,060	53,420	540	53,960	26	5	4	1
	Commercial	4,985	390	5,375	10	5,385	3	8	8	0
	Industrial	3,445	260	3,705	15	3,720	6	8	8	0
	Institutional	10,865	840	11,705	20	11,725	2	8	8	0
	Recreational	71,380	370	71,750	260	72,010	70	1	0	0
	Vacant/Agricultural	1,027,130	-4,350	1,022,780	-890	1,021,890	20	0	0	0
	Transportation	N/A		N/A	45					
	Total Developed Acreage(2)(3)	71,585	3,920	75,505	845	76,350	22	7	6	1

* Less than 2.5 acres.

(1) Ashtabula City is projected to have a population decrease throughout the projection period. Approximately "Developed" acres are projected to remain unused in 1990.
(2) Minus transportation land use because of inconsistencies in past accounting procedures.
(3) Total excluding agricultural and vacant land, and land for Route 20 bypass alternative (see text).

Source: Arthur D. Little, Inc. estimates, based on SIMPACT IV Model results.

Table 4-259

Projected Impact Requirement and Land Use Character of the Regional Study Area -- 1979-1990

	Residential		Commercial		Industrial		Institutional		Recreational		Vacant/Agriculture		Transportation		Total	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Conneaut																
Baseline 1990	1645	9	90	*	840	5	300	2	190	1	13,300	76	1180	7	17,545	100
Baseline & Impact 1990	1980	11	105	1	845	5	330	2	365	2	12,725	72	1195	7	17,545	100
Springfield Area																
Baseline	1030	4	50	*	55	*	475	2	55	*	20,930	88	1210	5	23,805	99
Baseline & Impact	1230	5	55	*	55	*	480	2	175	1	20,585	86	1225	5	23,805	99
Ohio Coastal Communities Kingsville																
Baseline	955	7	290	2	85	1	1415	10	205	2	10,035	72	890	6	13,875	100
Baseline & Impact	1100	8	290	2	85	1	1415	10	275	2	9810	71	900	6	13,875	100
Ashtabula Township																
Baseline	1290	15	115	1	1135	13	605	7	30	*	5085	60	225	3	8485	99
Baseline & Impact	1430	17	115	1	1135	13	605	7	100	1	4865	57	235	3	8485	99
Ashtabula City																
Baseline	1125	24	145	3	725	15	270	6	155	3	1790	38	530	11	4740	100
Baseline & Impact	1145	24	155	3	725	15	270	6	180	4	1735	37	530	11	4740	100
Saybrook Township																
Baseline	1635	8	470	2	420	2	515	3	955	5	15,510	77	575	3	20,080	100
Baseline & Impact	1695	8	470	2	420	2	515	3	975	5	15,425	77	580	3	20,080	100
Pa. Coastal Communities Girard Area																
Baseline	1625	6	440	2	170	1	500	2	575	2	20,200	81	1365	6	24,875	100
Baseline & Impact	1720	7	440	2	170	1	500	2	635	2	20,040	80	1370	6	24,875	100
Fairview Township																
Baseline	2215	12	200	1	75	*	520	3	245	1	13,935	76	1170	6	18,360	99
Baseline & Impact	2295	13	200	1	75	*	520	3	285	1	13,810	75	1175	6	18,360	99
Millcreek Township																
Baseline	4800	26	810	4	225	1	855	5	430	2	9395	50	2165	12	18,680	100
Baseline & Impact	4870	26	810	4	225	1	855	5	475	2	9275	50	2170	12	18,680	100
Ohio Regional Study Area																
Baseline	15,310	4	2080	*	3610	1	9745	2	9550	2	401,510	91	N/A		441,805	100
Baseline & Impact	16,100	4	2105	*	3615	1	9780	2	9910	2	400,240	91	N/A		441,750	100
Pa. Regional Study Area																
Baseline	53,420	5	5375	*	3705	*	11,705	0	71,750	6	1,022,780	88	N/A		1,168,735	100
Baseline & Impact	53,960	5	5385	*	3720	*	11,725	0	72,010	6	1,021,890	88	N/A		1,168,690	100

*Indicates less than one-half percent.

N/A = Not Available.

Source: Arthur D. Little, Inc. estimates, based on SIMPACT IV Model.

under baseline and impact conditions to illustrate potential changes in the land use character of the Coastal Communities.

The Local Study Area

4.441
The Ohio and Pennsylvania Local Study Area are projected to experience a total increase in developed land usage of 18 percent (735 acres) and 19 percent (515 acres) respectively, by 1990 if the proposed facility is built. Of this growth, 14 percent (575 acres) in Conneaut and 13 percent (345 acres) in Springfield is attributed to the projected secondary land use impacts linked to the proposed Lakefront Plant. The baseline rate of land use expansion is projected to be accelerated by an overall factor of 3.6 in Conneaut and by a factor of 2 in Springfield. This increased growth rate is projected to relate primarily to potential needs in the residential and recreational land use categories. Commercial growth in Conneaut although requiring fewer acres (15 acres) is projected to show the next greatest increase in the rate of development (300 percent). Projected Lakefront Plant-induced industrial, institutional transportation, and commercial requirements in Springfield are projected to be equal or less than projected baseline requirements. The rate of land development in Conneaut (1965-1977) was virtually nil while in Springfield three percent of the land was developed during the period 1971-1975. This indicates that the baseline growth rate for the projection period is projected to increase at a rate four times as great as in 1965-1977 in Conneaut and twice as great as the 1971-1975 period in Springfield. The additional plant-related land use requirement is projected to result in a growth rate 18 times as great as the 1965-1977 growth rate in Conneaut and six times as great as the 1971-1975 growth rate in Springfield. The projected distribution of land use in the communities under baseline and impact conditions is shown in Table 4-258. Although the rate of growth may be substantially affected, the projected acreage required is not substantial enough in any one category to create a change in the relative proportionate use of land. In Conneaut, a three percent redistribution of land use is projected under impact conditions. Residential land use would increase from nine percent to 11 percent, recreational land use could increase from one percent to two percent, and commercial land use would account for one percent of the total. The corresponding decrease in vacant and agricultural land would be from 76 percent to 72 percent. In Springfield, residential land use would increase by one percent, from four percent to five percent, recreational land use could increase by a fraction of a percentage point, and vacant and agricultural land would decrease from 88 percent to 86 percent. The proportion of land in commercial, industrial, institutional, and transportation land usage would vary insignificantly in both communities. Springfield is expected to grow at a faster rate, but to

remain primarily rural in character. Conneaut is expected to continue its trend toward suburbanization at an accelerated pace.

Plant-Induced Secondary Impacts on Archaeology

4.442
Without knowledge of the exact location of future development in the Local Study Area (or any of the other study areas), the impact potential of secondary development on cultural resources is difficult to assess. Knowledge of the probable location of historic and archaeological sites eligible for, on, or nominated to the National Register is available. However, unless concurrent review of the status of these resources is required as part of development proposals followed by action to protect or excavate such sites, it is possible that some would be adversely affected. For many routine developments, no such review or protection procedures are in effect. Therefore, it is likely that historic and archaeological sites not included on Federal listings would be lost.

Ohio Regional Study Area

4.443
The estimated impact increment would create very little change in the projected percentage distribution of land in the Regional Study Area (refer to Table 4-259). As a whole, the projected baseline land use character would be retained. Agricultural and rural land usage would continue to comprise 91 percent of the acreage in the Regional Study Area. However, approximately 700 acres in agricultural use (0.2 percent of total projected agricultural land in the Regional Study Area) would be developed between 1970 and 1990. The total growth in land use over the study period resulting from the baseline and plant-related land use requirement is projected to be two percent or about 2,600 acres. This requirement reflects a growth rate which would be slightly less than the historical growth rate for the same area (three percent) from 1970-1977, which is based on the assumption that higher density residential development would become increasingly important. The projected impact land use increments would accelerate the existing trend towards gradual urbanization in the area, and speci-fically, the Coastal Communities.

Ohio Coastal Communities

4.444
In the Ohio Coastal Communities (excluding Conneaut), the projected residential plant related requirement would accelerate land development in the Kingsville Area and Ashtabula Township. Ashtabula Township is projected to experience an accelerated rate of growth in transportation land use because the number of roads in the township

is relatively low. The projected plant-related impact requirement would call for a reuse of vacated space for recreational, commercial, and residential land in Ashtabula City, slowing the decline of growth in that city. Saybrook is projected to experience a small incremental increase in its growth rate from the impact requirement. The projected baseline growth rate for the town (19 percent) would far exceed the projected plant-related growth rate (two percent). The existing and projected distribution of land uses in the Ohio Coastal Communities is projected to experience little change. In the Kingsville Area and Ashtabula Township, the relative allocation of land would increase slightly towards residential and dedicated recreational and open space uses. These towns are projected to experience an accelerated rate of suburbanization. The projected moderation of the declining development trend in Ashtabula City is minimal and would not significantly alter land use patterns in this municipality. No measurable change in projected baseline land use patterns is anticipated in Saybrook under projected plant-related impact conditions.

Pennsylvania Regional Study Area

4.445
The developed land area and the projected baseline land use requirement is expected to be proportionately larger in Pennsylvania. Plant-related impact requirement in the Pennsylvania Regional Study Area is projected to accelerate land consumption by 22 percent as compared to an 86 percent acceleration above baseline in the Ohio Regional Study Area.

Pennsylvania Coastal Communities

4.446
The projected plant-related growth effects in Girard (three percent), Fairview (three percent), and Millcreek (one percent) are similar to those projected for Ashtabula City or Saybrook. Acceleration of the projected baseline residential growth rate in these communities varies with the distance each is from the proposed Lakefront site, ranging from an acceleration of 83 percent in Girard to 39 percent in Fairview to 21 percent in Millcreek. The growth rates in land development in Girard, Fairview, and Millcreek for 1971-1975 were approximately one percent, six percent, and 14 percent, respectively. The projected baseline growth rate in, and requirements for 1979-1990 is 11 times greater than 1971-1975 in Girard, twice as great in Fairview, and 60 percent of the historical growth rate in Millcreek. The projected impact-related growth rates would accelerate the baseline growth by a factor of 14 times the 1971-1975 growth rate in Girard, 2.5 times in Fairview, and would be 80 percent of the 1971-1975 growth rate in Millcreek.

Land Use Changes by Drainage Basins

4.447
Land areas affected by primary and secondary impacts of plant construction and operation may also be categorized according to the hydrologic drainage basin in which they are located. Table 4-260 through 4-267 present estimated land use changes predicted to result from construction and operation of the proposed plant.

Impacts on the Physical Environment

Terrestrial Regime

Site Development

a) Borrow Material

4.448
The types of earthwork operations which would occur at the proposed Lakefront Plant site during construction include:

- General site grading (cutting or filling.
  - -leveling the site grades for facility construction,
  - -alteration of site topography,
  - -landscaping and drainage,
  - -construction of disposal areas.
- Excavation for foundation construction, deep pits, utility trenches, and possible borrowing of material sources, and
- Backfilling of foundation and utility excavations.

4.449
In areas where plant structures or related facilities are to be located on fill, the applicant intends to use a clean granular soil as fill material. This material can be capped with finer grained, more impervious material if drainage through the facility into the foundation material is found to be a problem. Once the fill material is placed and compacted in uniform layers, plant facilities would then be constructed. The applicant has provided no information on quantity of fill required to achieve site grades and structure foundation levels. Onsite sources of fill may be used such as the granular material contained in strand deposits. However, this material contains more than 10 percent to 20 percent silt size particles which would make this material difficult to place and compact. If sufficient granular material is not available for general site fill beneath facilities, additional material would be brought in from outside sources. Processed sand and gravel may be required beneath ground floor slabs, roadways, railroads, possibly stockpiles and elsewhere if required for drainage or for proper supporting strength,

Table 4-260

Estimated Land Use Changes Linked to the Proposed Lakefront Plant by Drainage Basin -- Drainage Basin 1 #
(Acres)

		Drainage Basin 1 (Small Streams into Lake Erie)		
		Cumulative Changes[1]		
	Current	1981	1985	1990
Urban				
Commercial	799	*	*	*
Other Urban	3,054	+25	+44	+58
Rural				
Agricultural	12,734	-25	-44	-58
Other Rural Land	25,687			

(1) Does not include baseline land use changes, estimated in this drainage basin to be approximately 8.0 times the Lakefront Plant-related changes. No industrial land use changes related to the Lakefront Plant were included. Since only very small changes in this land use category were projected, the impact of this omission is minimal.

*Changes are estimated to be positive but negligible.

Source: Arthur D. Little, Inc. estimates.

See Figure 2-115

Table 4-261

Estimated Land Use Changes Linked to the Proposed Lakefront Plant by Drainage Basin -- Drainage Basin 2#
(Acres)

		Drainage Basin 2 (Ashtabula River)		
		Cumulative Changes(1)		
	Current	1981	1985	1990
Urban				
Commercial	525	+ 1	+ 1	+ 2
Other Urban	3,782	+29	+65	+105
Rural				
Agricultural	34,086	-30	-66	-107
Other Rural Land	51,126			

(1) Does not include baseline land use changes. Under baseline conditions, it is projected that no new urban land would be required, and in fact, population would likely decrease leaving a surplus of urban land. Thus, land use changes due to baseline and impact would be less than those projected here for impact alone. No industrial land use changes related to the Lakefront Plant were included. Since only very small changes in this land use category were projected, the impact of this omission is minimal.

Source: Arthur D. Little, Inc. estimates.

See Figure 2-115

Table 4-262

Estimated Land Use Changes Linked to the Proposed Lakefront Plant by Drainage Basin -- Drainage Basin 3 #
(Acres)

		Drainage Basin 3 (Small Streams into Lake Erie)		
		Cumulative Changes[1]		
	Current	1981	1985	1990
Urban				
Commercial	199	+ 8	+ 18	+ 30
Other Urban	2,673	+56	+147	+267
Rural				
Agricultural	1,585	-64	-165	-297
Other Rural Land	8,444			

[1] Does not include baseline land use changes, estimated in this drainage basin to be approximately 0.5 times the Lakefront Plant-related changes. No industrial land use changes related to the Lakefront Plant were included. Since only very small changes in this land use category were projected, the impact of this omission is minimal.

Source: Arthur D. Little, Inc. estimates.

See Figure 2-115

Table 4-263

Estimated Land Use Changes Linked to the Proposed Lakefront Plant by Drainage Basin -- Drainage Basin 4#
(Acres)

		Drainage Basin 4 (Conneaut Creek)		
		Cumulative Changes[1]		
	Current	1981	1985	1990
Urban				
Commercial	422	+ 7	+ 16	+ 27
Other Urban	3,135	+32	+ 88	+169
Rural				
Agricultural	50,950	-39	-104	-196
Other Rural Land	78,298			

[1] Does not include baseline land use changes, estimated in this drainage basin to be approximately 1.2 times the Lakefront Plant-related changes. No industrial land use changes related to the Lakefront Plant were included. Since only very small changes in this land use category were projected, the impact of this omission is minimal.

Source: Arthur D. Little, Inc. estimates.

See Figure 2-115

Table 4-264

Estimated Land Use Changes Linked to the Proposed Lakefront Plant by Drainage Basin -- Drainage Basin 5#
(Acres)

		Drainage Basin 5 (Pymatuning Reservoir) Cumulative Changes(1)		
	Current	1981	1985	1990
Urban				
Commercial	239	*	*	*
Other Urban	1,579	+19	+36	+53
Rural				
Agricultural	31,756	-19	-36	-53
Other Rural(2) Land	70,295			

(1) Does not include baseline land use changes, estimated in this drainage basin to be approximately 7.6 times the Lakefront Plant-related changes. No industrial land use changes related to the Lakefront Plant were included. Since only very small changes in this land use category were projected, the impact of this omission is minimal.

(2) Contains 16,136 acres in Pymatuning Reservoir.

*Changes are estimated to be positive, but negligible.

Source: Arthur D. Little, Inc. estimates.

See Figure 2-115

Table 4-265

Estimated Land Use Changes Linked to the Proposed Lakefront Plant by Drainage Basin -- Drainage Basin 6#
(Acres)

		Drainage Basin 6 (Crooked Creek and Small Streams into Lake Erie)		
		Cumulative Changes[1]		
	Current	1981	1985	1990
Urban				
Commercial	75	+ 2	+ 5	+ 8
Other Urban	916	+35	+102	+201
Rural				
Agricultural	12,187	-37	-107	-209
Other Rural Land	14,319			

(1) Does not include baseline land use changes, estimated in this drainage basin to be approximately 1.4 times the Lakefront Plant-related changes. No industrial land use changes related to the Lakefront Plant were included. Since only very small changes in this land use category were projected, the impact of this omission is minimal.

Source: Arthur D. Little, Inc. estimates.

See Figure 2-115

Table 4-266

Estimated Land Use Changes Linked to the Proposed Lakefront Plant by Drainage Basin -- Drainage Basin 7 #
(Acres)

		Drainage Basin 7 (Elk Creek and Small Streams into Lake Erie)		
		Cumulative Changes[1]		
	Current	1981	1985	1990
Urban				
Commercial	376	+ 1	+ 2	+ 3
Other Urban	2,333	+30	+67	+116
Rural				
Agricultural	36,315	-31	-69	-119
Other Rural Land	30,800			

[1] Does not include baseline land use changes, estimated in this drainage basin to be approximately 4.4 times the Lakefront Plant-linked changes. No industrial land use changes linked to the Lakefront Plant were included. Since only very small changes in this land use category were projected, the impact of this omission is minimal.

Source: Arthur D. Little, Inc. estimates.

See Figure 2-115

Table 4-267

Estimated Land Use Changes Linked to the Proposed Lakefront Plant by Drainage Basin -- Drainage Basin 8#
(Acres)

		Drainage Basin 8 (Walnut Creek and Small Streams into Lake Erie)		
		Cumulative Changes(1)		
	Current	1981	1985	1990
Urban				
Commercial	472	*	+ 1	+ 1
Other Urban	2,560	+48	+85	+144
Rural				
Agricultural	12,314	-48	-86	-145
Other Rural Land	13,833			

(1) Does not include baseline land use changes, estimated in this drainage basin to be approximately 10 times the Lakefront Plant-linked changes. No industrial land use changes linked to the Lakefront Plant were included. Since only very small changes in this land use category were projected, the impact of this omission is minimal.

* Changes are estimated to be positive but negligible.

Source: Arthur D. Little, Inc. estimates.

See Figure 2-115

such as backfill for culverts or pipes. This material is not available from on-site sources and will have to be imported from off-site quarries. In addition, select material such as screened gravel, crushed stone, or granular material would be required when fill is placed in direct contact with a completed structure or pipe. Similarly, where paved roadways or other load bearing surfaces are encountered, select granular non-frost-susceptible material is generally used. None of the above materials are found within the Lakefront site and must be procured from local or regional sources.

b) Foundations

4.450
Although actual elevations and loads for structures have not been finalized, generalized foundation recommendations based on past experience with steel mill construction and preliminary studies of subsurface soil and rock conditions at the site have been made. (4-6) Considering the available data on subsurface conditions, most of the structures at the site can probably be supported on shallow foundations consisting of either individual spread footings or reinforced concrete mats, provided the foundations are located in areas where dense glacial till soils occur at shallow depths 3.3 to 6.6 feet below ground surface. The glacial tills (especially the lower till) are dense to very dense on site and constitute an excellent bearing material. However, at several locations, near surface, deposits of soft lacustrine materials were encountered directly overlying the till. These materials are not adequate for foundation support, and would have to be excavated and replaced with suitable material or bypassed with piles driven into the till.

c) Construction Debris

4.451
Construction debris attributed to the proposed plant would involve about 700,000 to 800,000 tons of vegetation, 50 to 60 houses and 200,000 cubic yards of dredged material. Vegetation will be chipped and sold or used on-site as mulch. One alternative suggested by the applicant involves the burning of vegetation on-site. The Corps staff recommends that marketable timber be sold and that smaller trees be made available to the general public for use as firewood. All other material should be chipped. By following this procedure, the air quality impacts associated with open burning would be averted. Homes occupying the site will be relocated or demolished and disposed of by commerical haulers. Dredged material will be confined in an upland disposal area within the Lakefront site boundary.

Geologic Hazards

4.452
Neither the proposed plant nor the anticipated secondary development would effect the geologic hazard potential for earthquakes, landslides, or subsidence. Further, this project does not involve activities such as deep well injection or underground mining which would potentially create a geologic hazard condition.

Mineral Resources

4.453
Secondary development induced by the proposed Lakefront Plant will reduce access to the limited mineral resources of the Regional Study Area. For example, access to sand and gravel deposits is already inhibited by roads and rail lines constructed along major strand lines. There are no mineral resources on the proposed site that are of any significant value. Several old gas wells have been discovered but the yields are generally too low for industrial usage.

Erosion

a) Primary Site Impacts

4.454
The potential for erosion of the land surface is high since nearly 80 percent of the Lakefront Plant site contains soils derived from glacial or lacustrine deposits. Studies conducted by the applicant indicate that severe erosion can be expected along the exposed slopes of creek ravines traversing the site. The erosion potential of the more level portions of the site are estimated at 10-20 tons per acre/year. Those activities associated with plant construction which could lead to erosion are listed below:

- concurrent clearing, grubbing, and grading of the site,
- storage or topsoil,
- construction activities associated with the culverting of Turkey Creek.

4.455
A graph showing the total site acreage cleared per unit time is presented in Figure 4-42. Land clearing activities are regulated by the Commonwealth of Pennsylvania through the implementation of State Erosion Control regulations, however, no counterpart plan exists in the State of Ohio. To compensate for this problem, the applicant has agreed to apply the principles and procedures of the Pennsylvania erosion control plan to the entire Lakefront site. At the present time, the applicant has not developed detailed construction specifications thus, no erosion plan has been prepared. However, such a

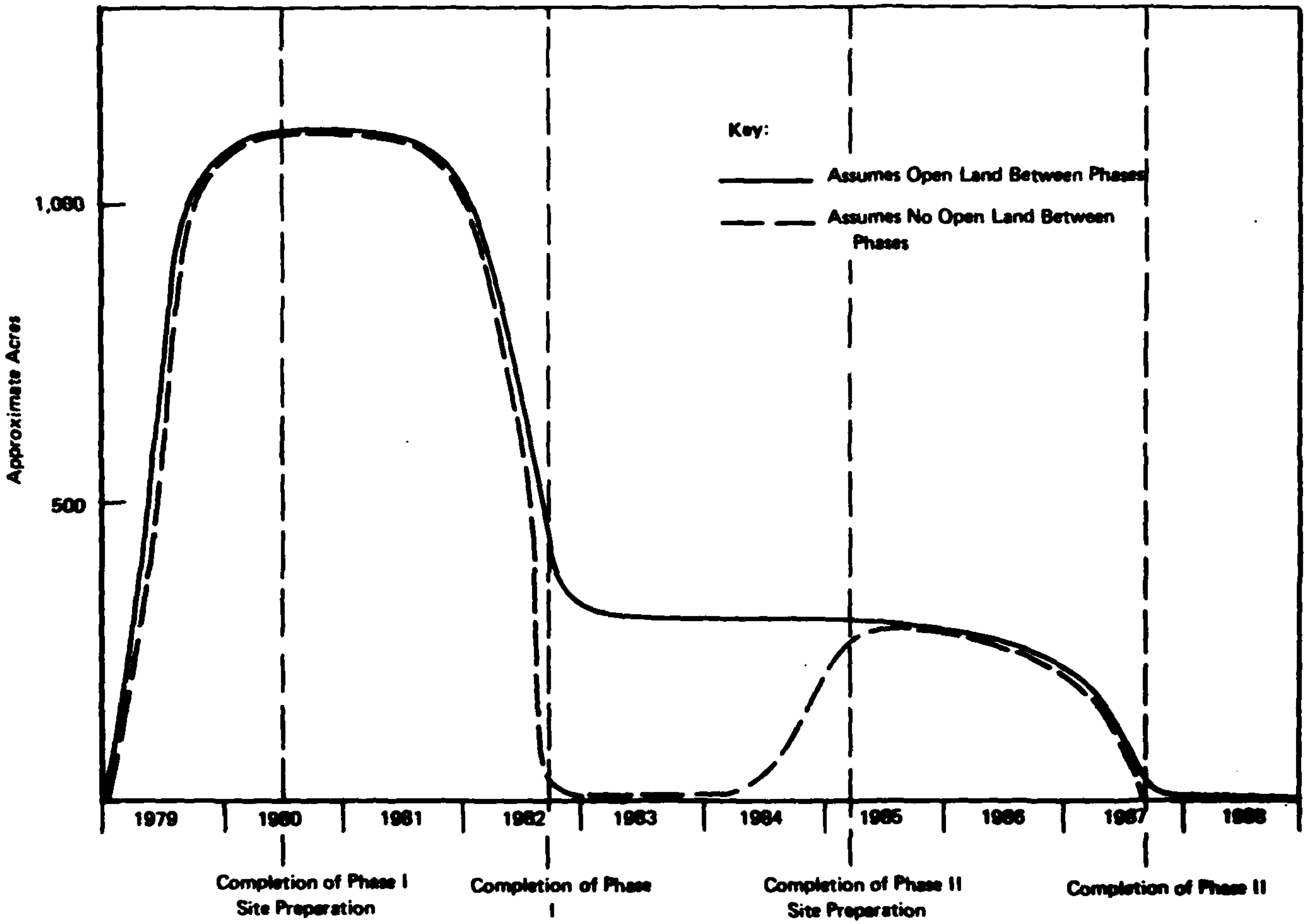


FIGURE 4—42 OPEN OR DISTURBED LAND DURING CONSTRUCTION AT THE PROPOSED LAKEFRONT PLANT SITE

plan will be developed prior to construction activities and will meet the approval of the Pennsylvania Department of Environmental Resources and the Erie County Soil Conservation District. Construction Contractors working on the Lakefront Plant site will be required to conduct their activities in conformance with the erosion control measures while the general implementation of the overall plan will be the responsibility of the applicant. The site will be inspected at least four times a year by the Erie County Health Department to insure conformance with the requirements of the required erosion control plan.

Shoreline Impacts

4.456
During construction the land surface will be cleared of vegetation resulting in an increase in surface water runoff toward Lake Erie. Uncontrolled, this runoff will widen and deepen existing drainage pathways to Lake Erie while new gullies and rills will be cut at other locations. This temporary increase in shoreline erosion will add material to the littoral drift at the expense of a localized decline in water quality. Excavation of an underwater trench perpendicular to the shore may temporarily impede littoral drift during the installation of the plant intake and discharge pipelines. However, if the excavated trench is backfilled as the pipe is installed, the overall impact will be negligible.

4.457
Stormwater runoff from developed plant areas will be impounded temporarily in a treatment pond prior to release to Lake Erie or the nearest available water body. Runoff from undeveloped areas would be intercepted by diversion ditches (the location and extent of which has not been defined by the applicant) and discharged into Lake Erie. Implementation of these control measures will substantially decrease sheet flow over the lake bluff reducing erosion. However, the diversion of runoff from undeveloped portions of the site into one or more of the intermittent Lake Erie tributaries may increase stream bank erosion unless properly designed outfall structures are installed.

4.458
Currently, the applicant has no plans to stabilize the shoreline bluffs in the vicinity of the Lakefront Plant site. Therefore, erosion of the shoreline will continue at the same rate as indicated under baseline conditions. Stabilization of 100-200 feet of shoreline in the vicinity of the plant pumphouse will be accomplished to protect the intake and discharge pipelines placed in Lake Erie. This riprapped section of shoreline would be more resistant than the adjoining shoreline and as such may form a headland as erosion proceeds. The headland would then act as a barrier to littoral

materials moving along the shoreline. However, even if such a headland formed its effects would be insignificant since the volume of material contained in the littoral drift is low. Overall, the installation of the riprap along this section of shoreline would have no impact on regional shore erosion patterns. Installation of the riprap as planned will result in the permanent loss of less than 0.1 acre of littoral habitat. However, replacement of the sand and smooth bedrock substrate with rock rubble having a greater surface may increase macroinvertebrate diversity to some degree.

b) Secondary Impacts

4.459
The construction and operation of the proposed Lakefront plant is expected to induce secondary development, primarily within the Principal Study Area. To accommodate the needs of the incoming population, agricultural, vacant and forested land would be converted to residential and other basically urban land usages. As development occurs, vegetation would be removed and soil would be disturbed over large areas. Typically, erosion rates from those disturbed areas might be as high as 20 tons/acre-year, approximately 10 to 100 times greater than the average erosion rate in this region. In some steeply sloped areas, localized erosion rates might be as high as 100-200 tons/acre-year.

4.460
Sediment losses from construction sites associated with Lakefront Plant-induced secondary development have been estimated for eight drainage basins. The results are shown in Table 4-268. On a per acre basis, the most severely impacted drainage basin would be Drainage Basin 3. Within this drainage basin, average erosion rates might increase almost 10 percent as a result of the new construction. However, the projected losses due to erosion will be significantly reduced in Pennsylvania due to uniform enforcement of erosion control regulations. When development reaches a stable level, average erosion rates in these areas would likely drop below original values as a result of the protective presence of pavement and structures. Secondary development would likely induce accelerated streambank erosion. The removal of vegetation during construction and the paving and developing of land tends to increase the volume of runoff during storm events. Additionally, the replacement of meandering natural waterways and vegetated area by shortened paved channels or open land results in intensified runoff flows of shorter duration. Both these factors tend to accelerate streambank erosion. Although the regional analysis of runoff indicates that significant regional changes in stream flows are not expected, runoff dynamics in local streams adjacent to new developments might be altered significantly, resulting in accelerated streambank erosion.

Table 4-268

Erosion from Construction Sites[1]

Drainage Basin[2]	Estimated Acreage	Estimated Current Erosion (Tons/Year)[3]	Estimated Total Erosion from Construction Sites[4] 1981	1985
1. Small Streams - Lake Erie	42,273	45,000	0	0
2. Ashtabula River	89,519	100,000	80	200
3. Small Streams - Lake Erie	12,903	10,000	700	1,000
4. Conneaut Creek	132,806	155,000	700	700
5. Pymatuning Reservoir	103,868	100,000	0	20
6. Crooked Creek and Small Streams - Lake Erie	27,498	30,000	900	800
7. Elk Creek and Small Streams-Lake Erie	69,825	80,000	160	200
8. Walnut Creek and Small Streams - Lake Erie	29,180	30,000	0	200

(1) Assuming that each site would be open for 1.75 years and would be experiencing erosion at the rate of 20 tons of sediment per acre per year.
(2) See Figure 2-76.
(3) Rural lands only.
(4) Associated with Lakefront Plant-related Development only.

Source: Arthur D. Little, Inc. estimates.

On-site Solid Waste Management

4.461
Three types of disposal areas are proposed for the Lakefront site. These include lined impoundments for fine grain wastes, containment areas for bulky wastes, and clean fill sites for spent refractories. The chemistry and permeability of the soils beneath the lined impoundments would not be altered unless there were a break in the lining material. In the event of such an occurrence, the leachate could affect soil permeability as precipitates filter out of solution and soil chemistry as ions are exchanged on particle surfaces. However, the glacial till underlying the Lakefront site is very impermeable, thus, the long-term effects of leaching would be minimal.

4.462
Since the site is in a Zone 2 for seismic risk, moderate earthquakes are possible. Special precautions in the impoundment design would be necessary to insure stability. The liner selected must be sufficiently elastic and flexible to survive the potential vibrations without breaking. The potential for lining breakage and subsequent leaching can occur. Therefore, the Corps of Engineers staff recommends that a porous collection system be placed under these disposal areas so that regular monitoring of groundwater or surface water seepage can be accomplished.

Atmospheric Regime

Impacts During Construction

4.463
The ambient air quality standards would not be violated during the construction phase if proper dust suppression methods are implemented. The principal impact of construction on air quality would be brought by increased dust emissions. Several operations, including clearing, filling, grading and construction of roads, parking areas, major facilities, etc. can generate dust; transport and movement of fill material would be a major source. Equipment traffic over temporary roads at the construction site would generate dust emissions over the duration of the construction period. Dust emissions would vary from day to day depending on the level of activity, the specific operations, and the prevailing weather. The estimation of dust emission rates during construction is heavily dependent on the soil texture, the silt content, the moisture content, and on meteorological factors such as frequency of precipitation, atmospheric turbulence, etc. Construction activity levels influence dust emission rates significantly also. However, it is extremely difficult to quantify the variation. From the USEPA "Compilation of Emission

Factors" AP-42, Sect. 11.2.4 dated December, 1975, an estimate of the emission from construction can be calculated. The construction emissions can then be compared with the emissions from plant operations, to determine the relative impacts during construction. In AP-42, an emission rate of 1.2 tons/acre/month is reported based on measurements. This emission factor is based on semiarid conditions with a precipitation evaporation (P-E) index of 50, while the site area would have a nominal index of 116 as the average between northeastern Ohio and northwestern Pennsylvania. The emission factor is proportional to the inverse square of the P-E index. This correction decreased the factor for the site to 0.22 tons/acre/month equivalent to a factor of 14.9 lbs/acre/day.

4.464
In the entire area of the plant site, heavy construction work is planned for 550 acres. Thus, the average emissions attributable to construction for both steps of the project could amount to 123 tons per month or 8,200 lbs per day. The separate contribution of emissions arising from construction vehicles have been independently estimated to be about 0.1 percent for low speed heavy duty vehicles with average daily traffic of 900 miles and about 1.4 percent for light duty vehicles with average daily traffic of 9,500 miles. Thus, the construction traffic emissions are not significant within the limits of this estimate. These emission rates assume uncontrolled conditions. Wet spraying of the construction area will be employed and a reduction of emission rates by 50 percent can be anticipated, according to USEPA AP-42. The resulting emission rates become 4,200 lbs per day or an average of 170 lbs/hour.

4.465
The sum of estimated dust emissions on an hourly average basis during construction is on the same order of magnitude as the estimated fugitive dust emissions released during plant operation. The contribution of plant fugitive emissions to local air quality was presumed to be representative of the effect of emissions during construction. This presumption has been tested by separate modeling of the emission from construction on an annual or long-term basis. The result, in agreement with the presumption, shows a maximum contribution of 6 ug/m^3 at only one receptor on the western perimeter of the plant. The particulate increases should not cause the annual average standards to be violated. Short-term standards would not be exceeded if proper mitigative measures were implemented such as wet spraying or reducing activity during extremely dry periods. Concentrations of other pollutants would be temporarily increased in the area due to exhausts from trucks and earthmoving vehicles. However, these emissions would be considerably smaller than the mechanical entrainment of dust and would not present any major impacts.

Impacts During Operations

a) Particulates and Sulfur Dioxide

Long-Term Particulate Concentrations

4.466
The impact of the proposed Lakefront Plant on long-term particulate concentrations for the region has been determined by modeling the annual average emissions inventory. These data along with the locations of the sources and operating parameters are presented in Table 1-23. Emission impacts on property line ambient particulate concentrations were determined by using the Modified Climatological Dispersion Model (CDM). This program, developed by the Meteorology Laboratory of the Environmental Applications Branch of the EPA, is used to estimate the long-term average concentrations of non-reactive gaseous pollutants. The CDM describes the spreading of a plume as it is transported downwind from a continuously emitting source. For the purposes of this model, the plume is assumed to have a Gaussian distribution in the vertical direction and a uniform distribution in the horizontal direction. To determine operation impacts, five individual years of meteorological data (1972-1976) obtained from Erie airport were used in the modeling. These data were processed in the Star (day/night) format by the National Climatic Center to give the trifrequency wind rose for each individual year. All roof monitors, rooftop stacks and fugitive emissions were input as area sources (refer to Table 1-23).

4.467
The heights of the area emission sources were considered to be the same as the release heights with no plume rise occurring. This estimate is conservative since many of the warmer gases escaping from roof monitors will form buoyant plumes and will rise before advecting downwind. Six area sources were utilized in the model. These included:

(1) ore storage area,

(2) coal storage area,

(3) raw materials processing,

(4) coke plant including coal handling,

(5) iron and steel making operations, and

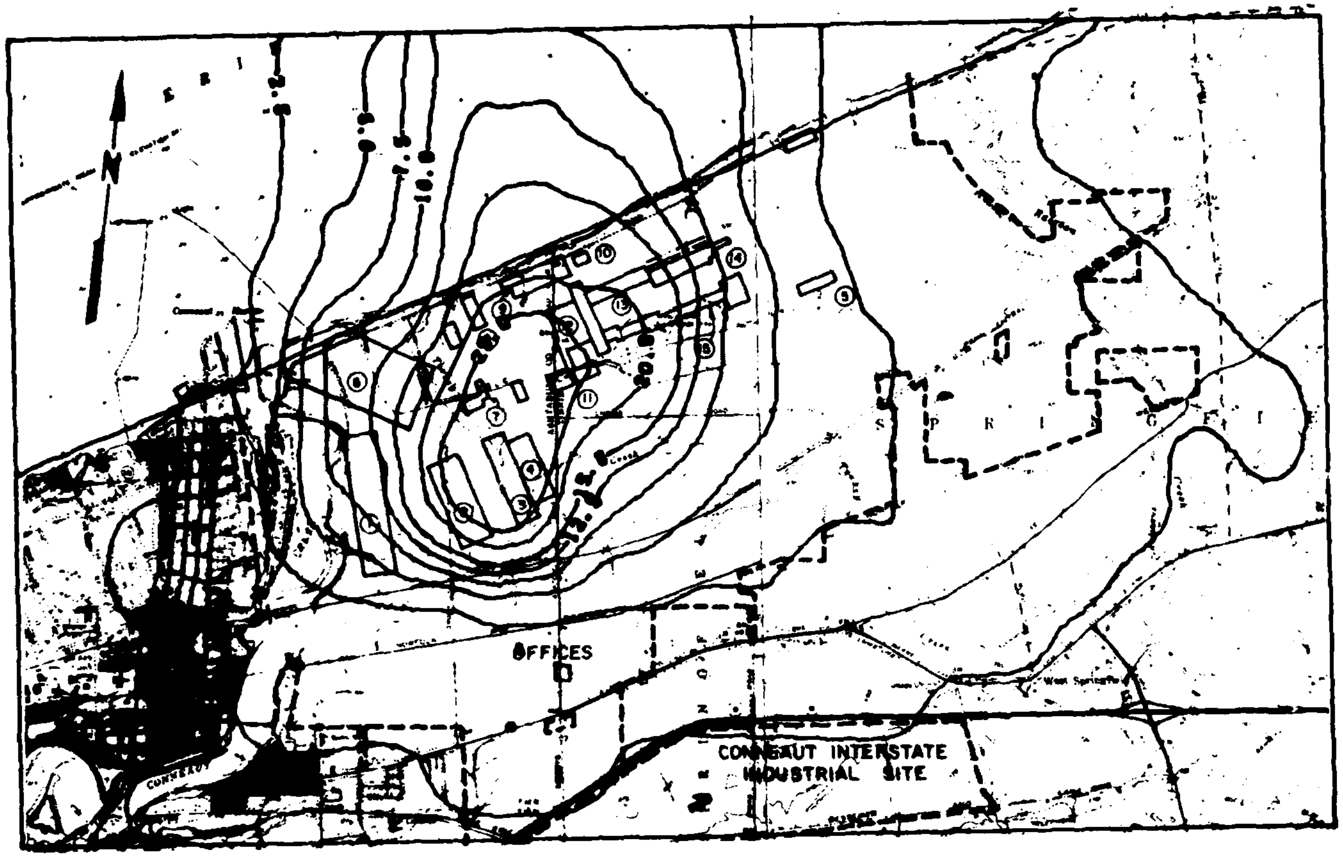
(6) slag processing.

The southwest corner coordinates of each of these areas are presented in Table 1-23.

4.468
The model included all point and area sources on the proposed site in determining the expected property line concentrations. (The detailed computer output is on file with Corps of Engineers, Buffalo District.) A receptor grid formed by 500-meter intervals was utilized to determine the maximum impact for each individual year. The computer output can be summarized by generating isopleth plots of ambient concentrations around the site. Isopleths were generated from the CDM by using the CALCOMP GPCP Program. Figures 4-43 through 4-47 show the isopleths for each of the years 1972-1976 in terms of annual arithmetic means expressed as micrograms per cubic meter. It is clear from visual examination of these figures that there are no significant variations in the concentrations of suspended particulate at any given receptor for any of the five years. The maximum on-land concentration approached at or near the proposed plant boundaries is 5.0 ug/m^3. This value is well within the maximum allowable concentration for prevention of significant deterioration, which is 19 ug/m^3 (annual geometric average). The additional five micrograms from the plant would not cause the secondary standard of 60 ug/m^3 to be exceeded. Based on the 1976-1977 monitor stations in Conneaut and the 1977 monitors at the U. S. Steel site, the estimated annual geometric mean background for the region is 46 ug/m^3. The long-term average impact on Erie, PA would be less than 1 ug/m^3.

Long-Term Sulfur Dioxide Impacts

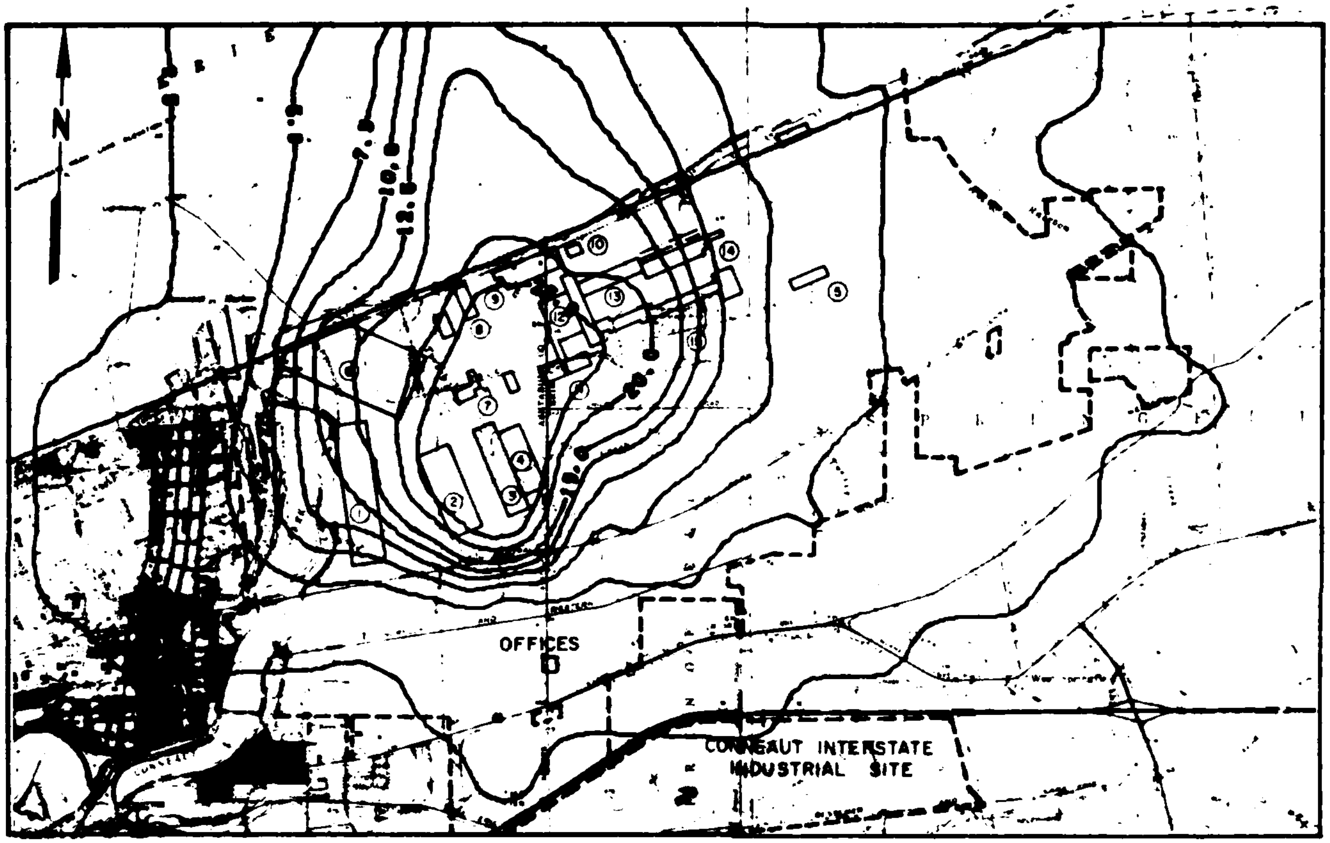
4.469
The calculated additional increment from the proposed Lakefront Plant of 5 ug/m^3 OF SO_2 would not violate the PSD regulation or cause the annual average standard to be violated. This conclusion is supported by the following analysis. The emissions inventory in Table 1-23 and the average annual wind roses from Erie Airport for the years 1972-1976 were utilized in the CDM as described in the previous subsection to determine the sulfur dioxide impact of the proposed plant. Isopleths were generated from the sulfur dioxide impact of the proposed plant. Isopleths were generated from the CDM output using the CALCOMP GPCP Program. Figures 4-48 through 4- 52 show the isopleths for each of the years 1972-1976 in terms of annual arithmethic means expressed as ug/m^3. It is clear from visual examination of these figures that there are no significant variations in the concentration of sulfur dioxide at any given receptor for any of the five years. The maximum on-land concentration at or near the proposed plant boundaries is 5.0 ug/m^3. This value is well within the maximum allowable concentration for prevention of significant



- - - - - - PROPERTY LINES

1. COAL STORAGE
2. COAL BLENDING
3. COKE OVENS
4. COKE OVEN BY-PRODUCTS PLANT
5. MAINTENANCE SHOPS
6. RAW MATERIAL STORAGE
7. POWER HOUSE
8. SINTER PLANT
9. WATER INTAKE AND TREATMENT
10. OXYGEN PLANT
11. BLAST FURNACES
12. STEELMAKING AND CASTING
13. HOT STRIP MILL
14. STRIP FINISHING
15. PLATE MILL

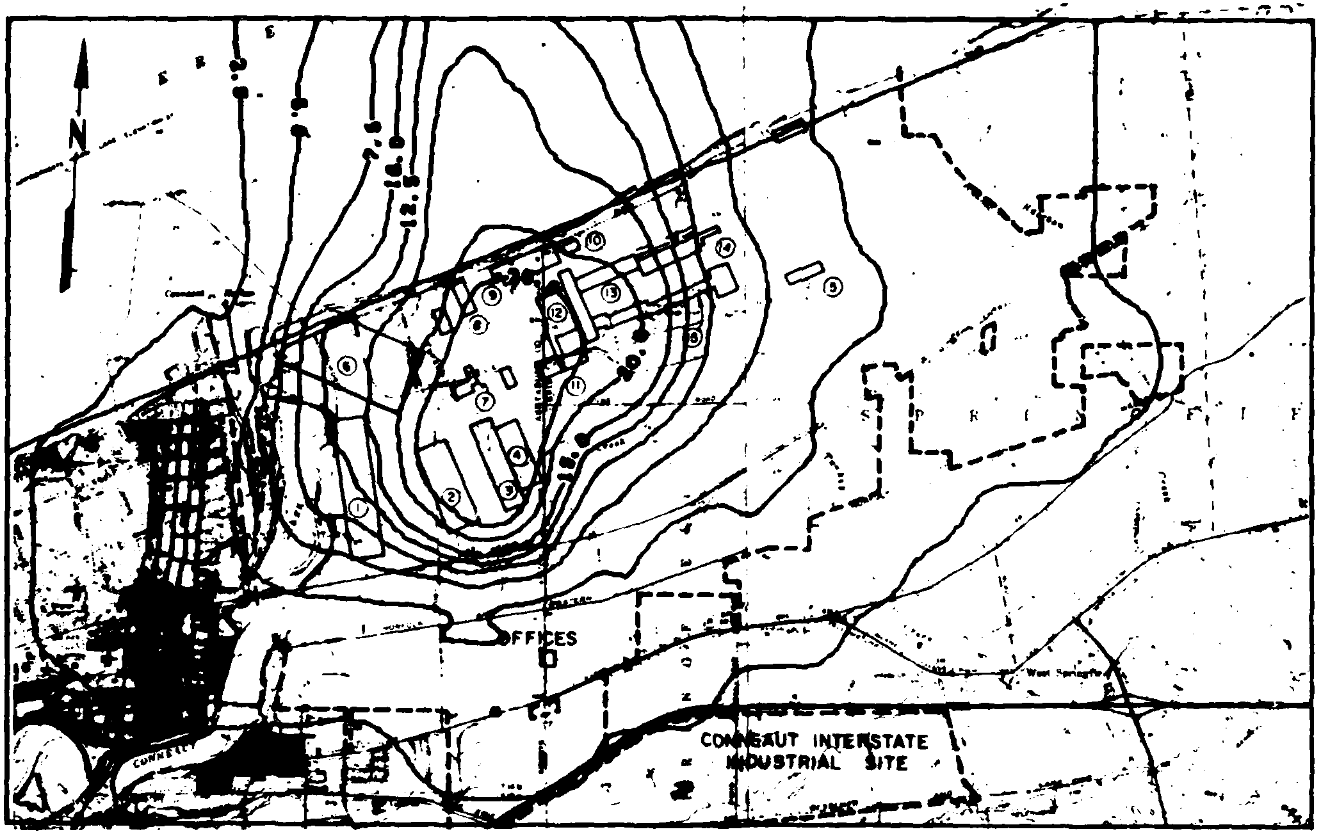
FIGURE 4–43 ISOPLETHS OF TOTAL SUSPENDED PARTICULATES CONTRIBUTIONS FROM THE PROPOSED LAKEFRONT PLANT USING 1976 METEOROLOGICAL DATA IN CDM ($\mu g/m^3$)



- - - - - - PROPERTY LINES

1. COAL STORAGE
2. COAL BLENDING
3. COKE OVENS
4. COKE OVEN BY-PRODUCTS PLANT
5. MAINTENANCE SHOPS
6. RAW MATERIAL STORAGE
7. POWER HOUSE
8. SINTER PLANT
9. WATER INTAKE AND TREATMENT
10. OXYGEN PLANT
11. BLAST FURNACES
12. STEELMAKING AND CASTING
13. HOT STRIP MILL
14. STRIP FINISHING
15. PLATE MILL

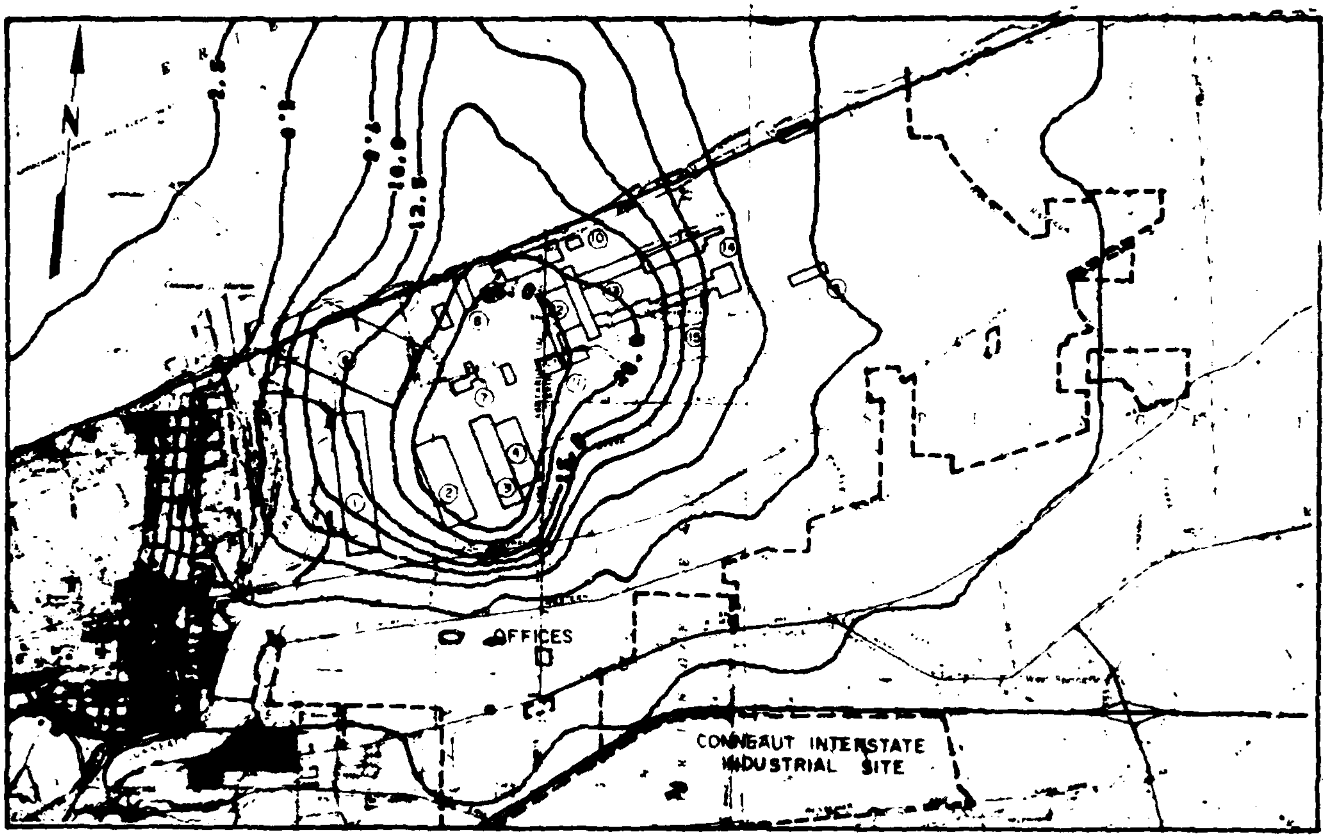
FIGURE 4—44 ISOPLETHS OF TOTAL SUSPENDED PARTICULATES CONTRIBUTIONS FROM THE PROPOSED LAKEFRONT PLANT USING 1975 METEOROLOGICAL DATA IN CDM ($\mu g/m^3$)



- - - - - - PROPERTY LINES

1. COAL STORAGE
2. COAL BLENDING
3. COKE OVENS
4. COKE OVEN BY-PRODUCTS PLANT
5. MAINTENANCE SHOPS
6. RAW MATERIAL STORAGE
7. POWER HOUSE
8. SINTER PLANT
9. WATER INTAKE AND TREATMENT
10. OXYGEN PLANT
11. BLAST FURNACES
12. STEELMAKING AND CASTING
13. HOT STRIP MILL
14. STRIP FINISHING
15. PLATE MILL

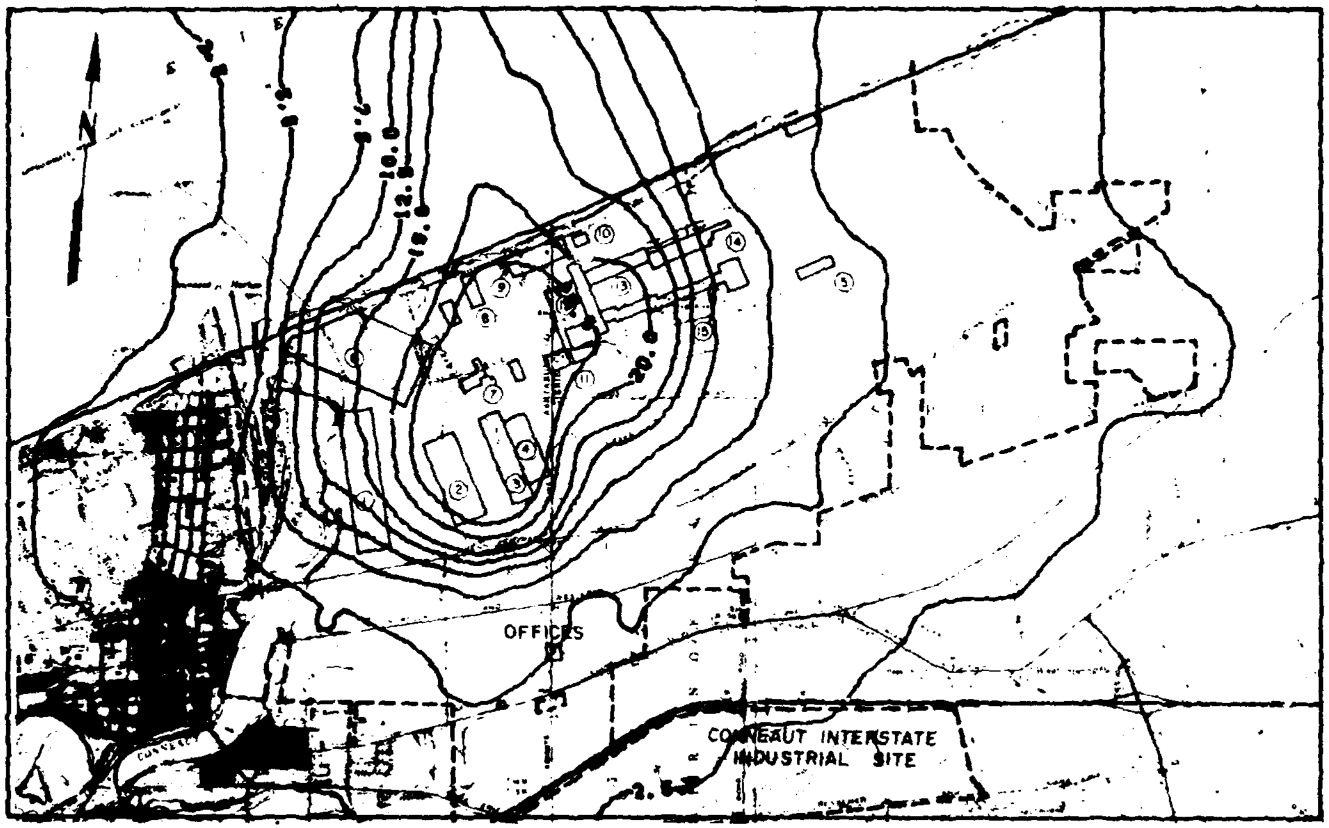
FIGURE 4–45 ISOPLETHS OF TOTAL SUSPENDED PARTICULATES CONTRIBUTIONS FROM THE PROPOSED LAKEFRONT PLANT USING 1974 METEOROLOGICAL DATA IN CDM ($\mu g/m^3$)



- - - - - - PROPERTY LINES

1. COAL STORAGE
2. COAL BLENDING
3. COKE OVENS
4. COKE OVEN BY-PRODUCTS PLANT
5. MAINTENANCE SHOPS
6. RAW MATERIAL STORAGE
7. POWER HOUSE
8. SINTER PLANT
9. WATER INTAKE AND TREATMENT
10. OXYGEN PLANT
11. BLAST FURNACES
12. STEELMAKING AND CASTING
13. HOT STRIP MILL
14. STRIP FINISHING
15. PLATE MILL

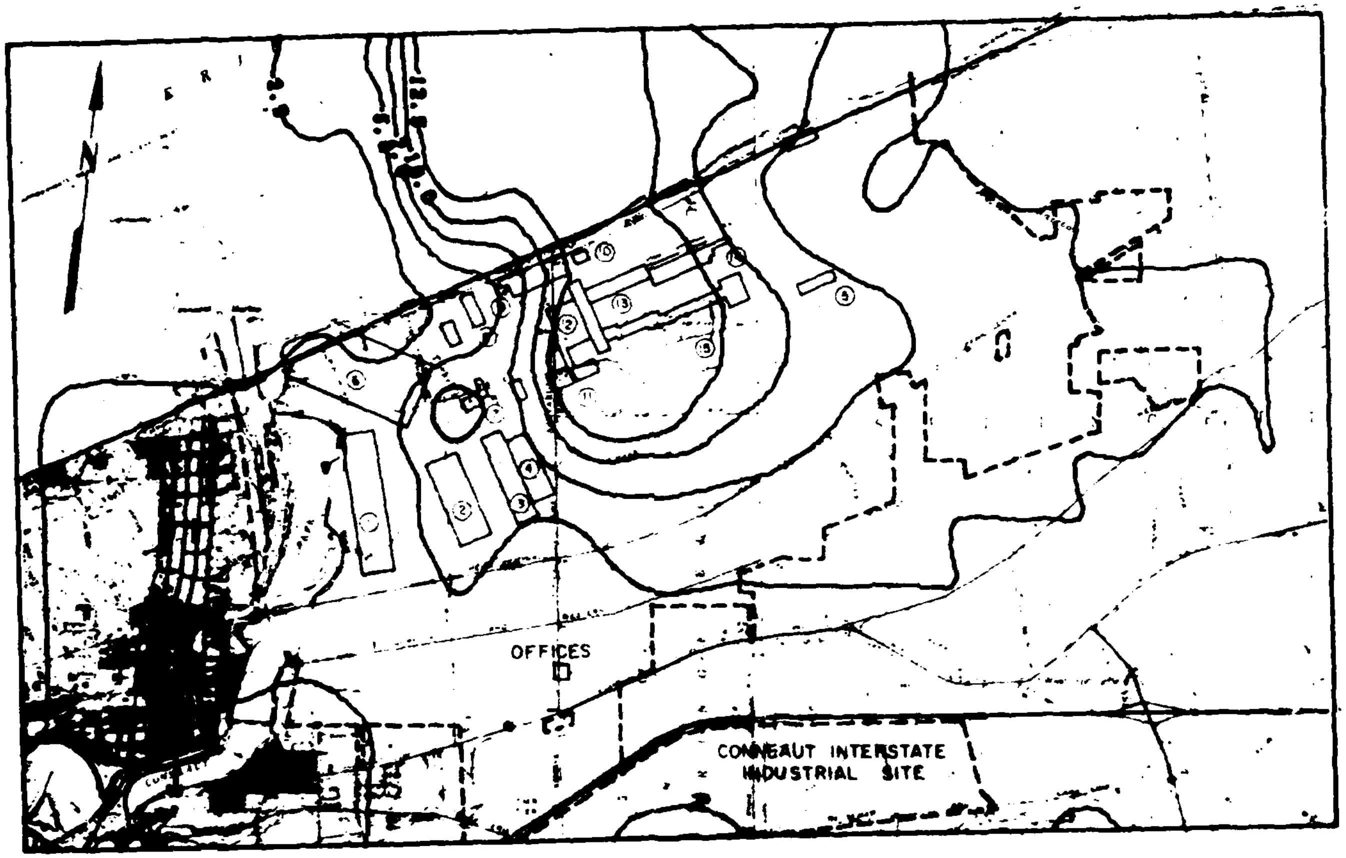
FIGURE 4–46 ISOPLETHS OF TOTAL SUSPENDED PARTICULATES CONTRIBUTIONS FROM THE PROPOSED LAKEFRONT PLANT USING 1973 METEOROLOGICAL DATA IN CDM ($\mu g/m^3$)



- - - - - - PROPERTY LINES

1. COAL STORAGE
2. COAL BLENDING
3. COKE OVENS
4. COKE OVEN BY-PRODUCTS PLANT
5. MAINTENANCE SHOPS
6. RAW MATERIAL STORAGE
7. POWER HOUSE
8. SINTER PLANT
9. WATER INTAKE AND TREATMENT
10. OXYGEN PLANT
11. BLAST FURNACES
12. STEELMAKING AND CASTING
13. HOT STRIP MILL
14. STRIP FINISHING
15. PLATE MILL

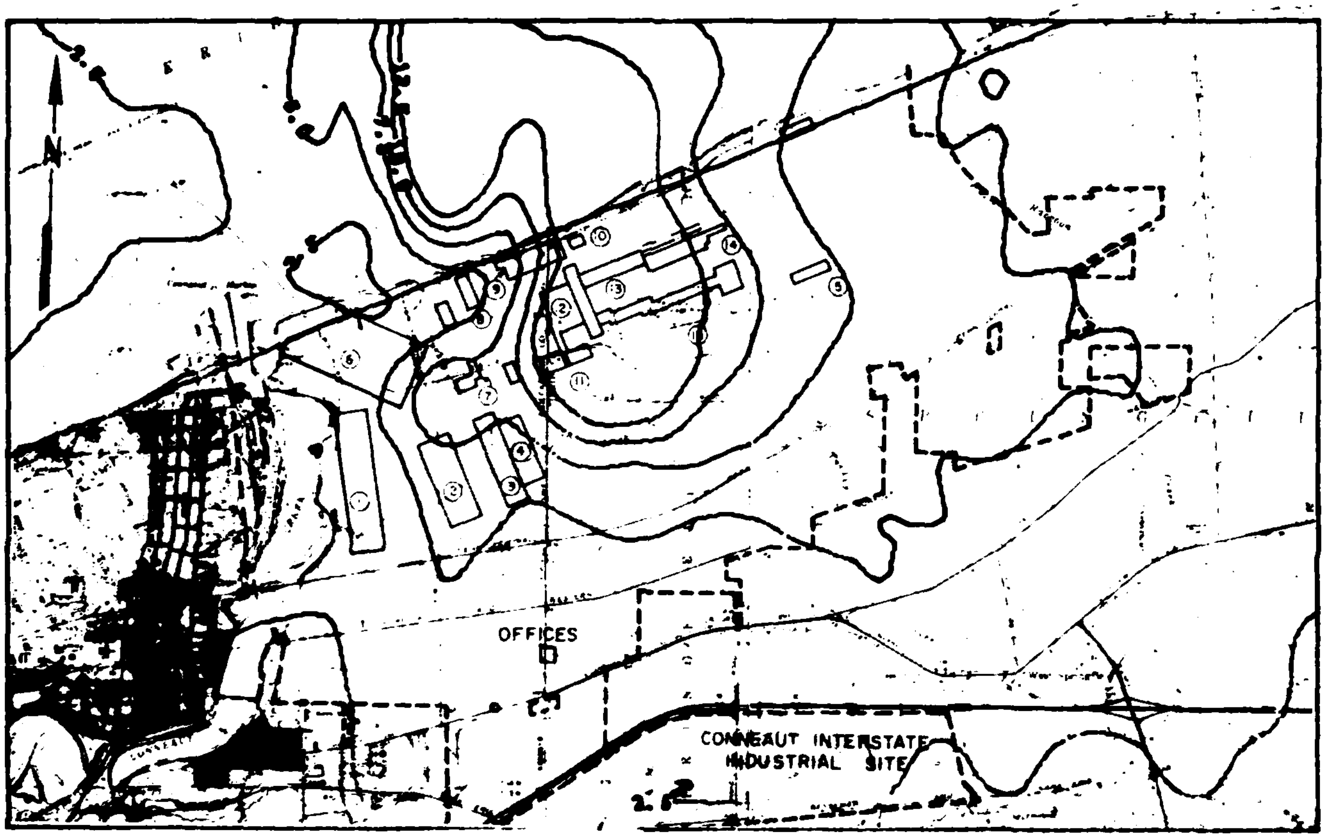
FIGURE 4–47 ISOPLETHS OF TOTAL SUSPENDED PARTICULATES CONTRIBUTIONS FROM THE PROPOSED LAKEFRONT PLANT USING 1972 METEOROLOGICAL DATA IN CDM ($\mu g/m^3$)



- - - - - - PROPERTY LINES

1. COAL STORAGE
2. COAL BLENDING
3. COKE OVENS
4. COKE OVEN BY-PRODUCTS PLANT
5. MAINTENANCE SHOPS
6. RAW MATERIAL STORAGE
7. POWER HOUSE
8. SINTER PLANT
9. WATER INTAKE AND TREATMENT
10. OXYGEN PLANT
11. BLAST FURNACES
12. STEELMAKING AND CASTING
13. HOT STRIP MILL
14. STRIP FINISHING
15. PLATE MILL

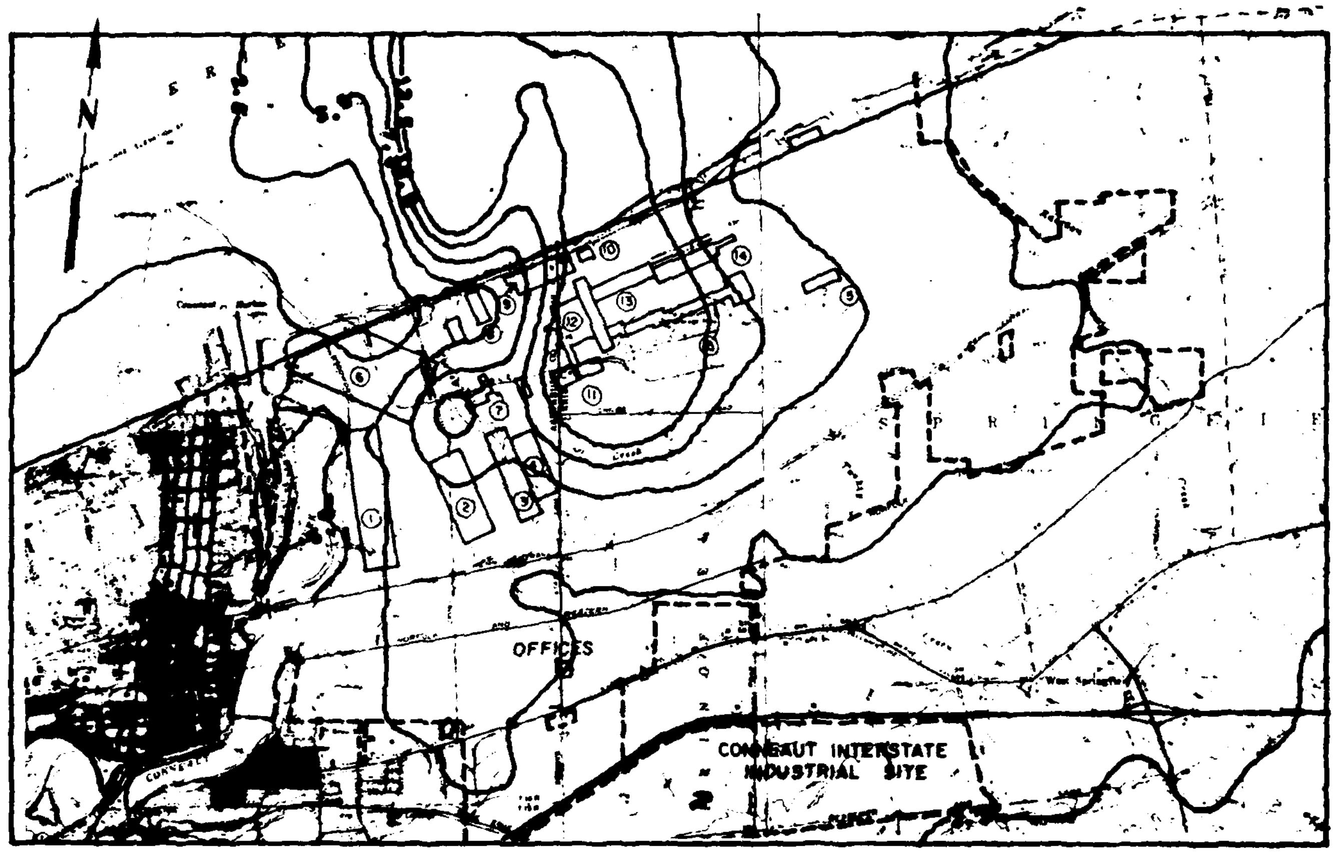
FIGURE 4–48 ISOPLETHS OF SO_2 CONTRIBUTIONS FROM THE PROPOSED LAKEFRONT PLANT USING 1976 METEOROLOGICAL DATA IN CDM ($\mu g/m^3$)



- - - - - - PROPERTY LINES

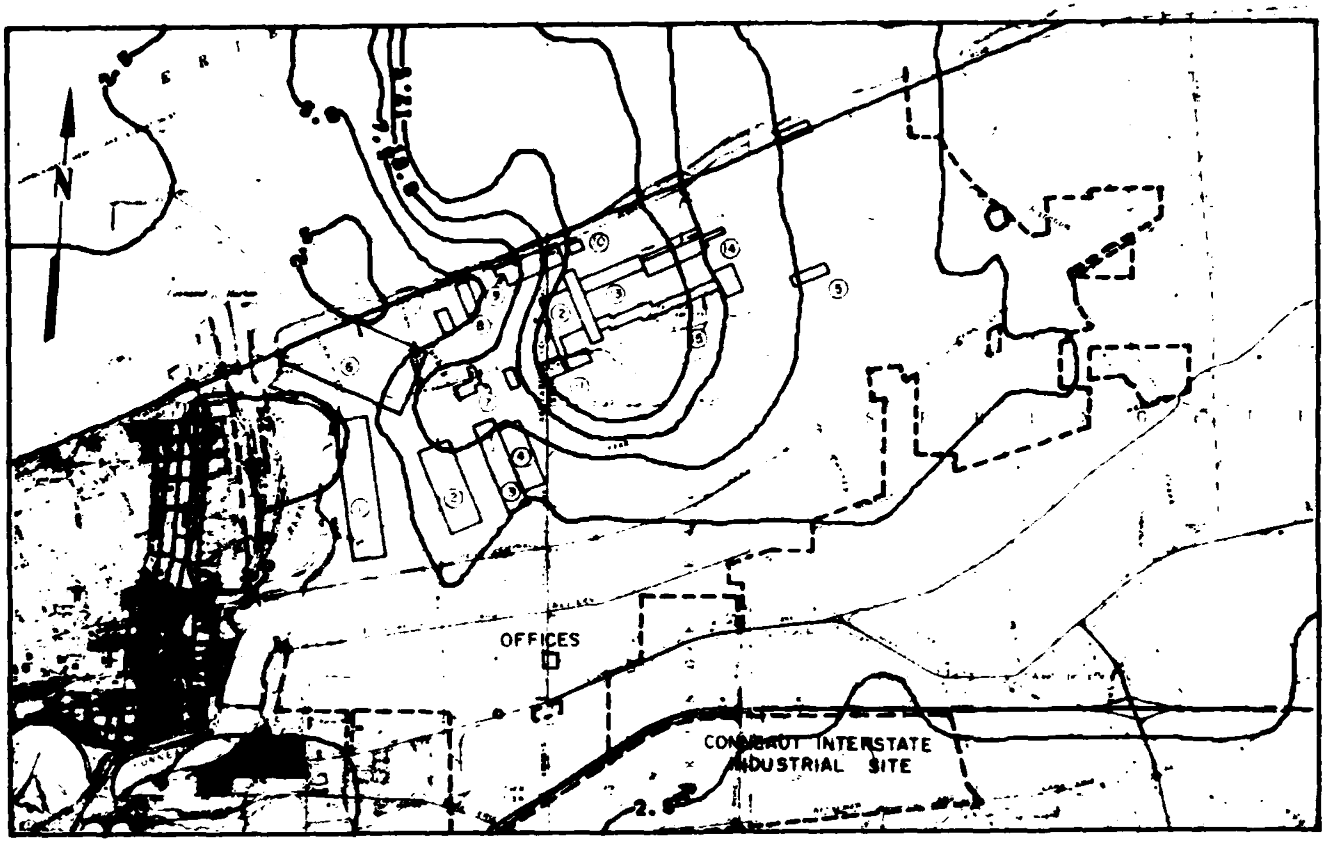
1. COAL STORAGE
2. COAL BLENDING
3. COKE OVENS
4. COKE OVEN BY-PRODUCTS PLANT
5. MAINTENANCE SHOPS
6. RAW MATERIAL STORAGE
7. POWER HOUSE
8. SINTER PLANT
9. WATER INTAKE AND TREATMENT
10. OXYGEN PLANT
11. BLAST FURNACES
12. STEELMAKING AND CASTING
13. HOT STRIP MILL
14. STRIP FINISHING
15. PLATE MILL

FIGURE 4–49 ISOPLETHS OF SO_2 CONTRIBUTIONS FROM THE PROPOSED LAKEFRONT PLANT USING 1975 METEOROLOGICAL DATA IN CDM ($\mu g/m^3$)



------- PROPERTY LINES
1. COAL STORAGE
2. COAL BLENDING
3. COKE OVENS
4. COKE OVEN BY-PRODUCTS PLANT
5. MAINTENANCE SHOPS
6. RAW MATERIAL STORAGE
7. POWER HOUSE
8. SINTER PLANT
9. WATER INTAKE AND TREATMENT
10. OXYGEN PLANT
11. BLAST FURNACES
12. STEELMAKING AND CASTING
13. HOT STRIP MILL
14. STRIP FINISHING
15. PLATE MILL

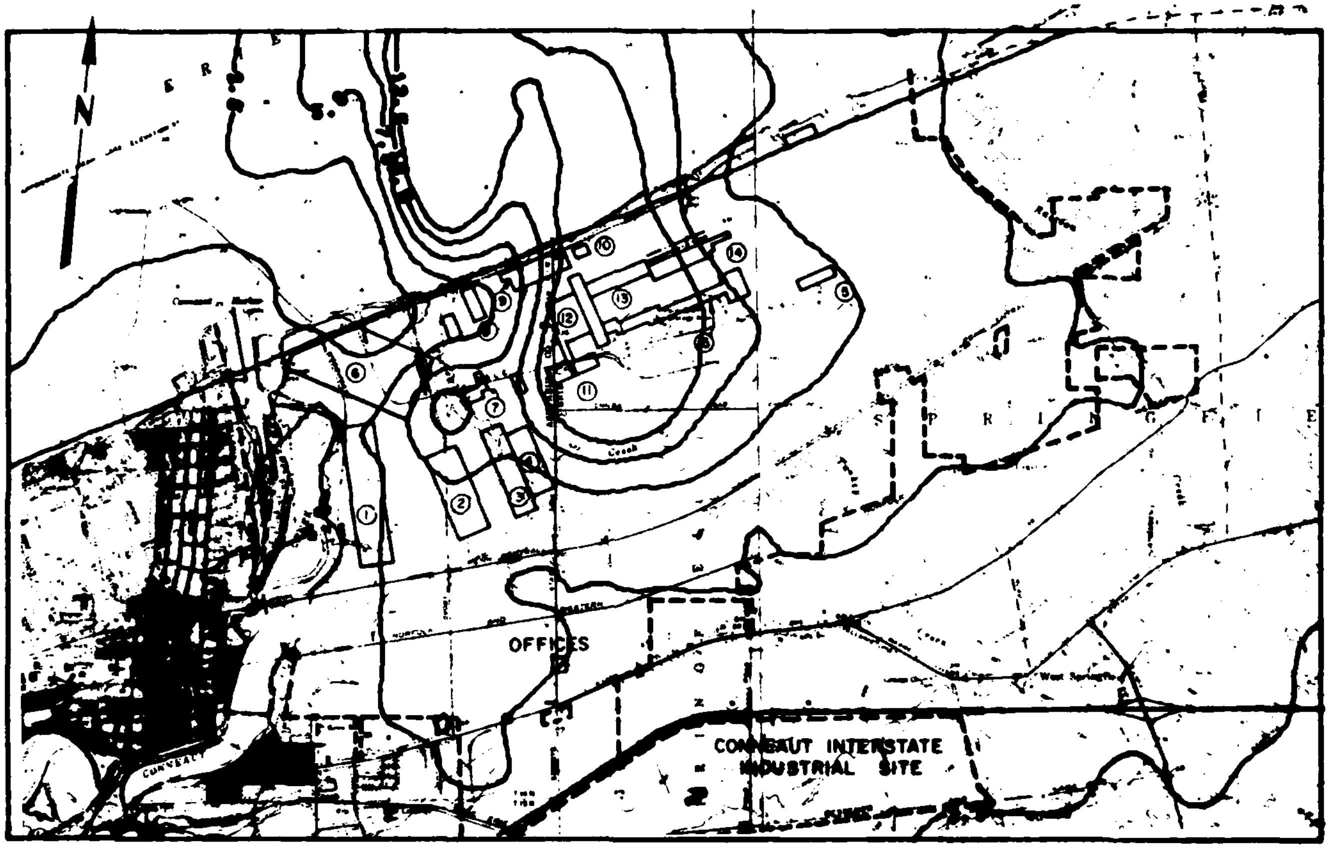
FIGURE 4–50 ISOPLETHS OF SO_2 CONTRIBUTIONS FROM THE PROPOSED LAKEFRONT PLANT USING 1974 METEOROLOGICAL DATA IN CDM ($\mu g/m^3$)



- - - - - - PROPERTY LINES

1. COAL STORAGE
2. COAL BLENDING
3. COKE OVENS
4. COKE OVEN BY-PRODUCTS PLANT
5. MAINTENANCE SHOPS
6. RAW MATERIAL STORAGE
7. POWER HOUSE
8. SINTER PLANT
9. WATER INTAKE AND TREATMENT
10. OXYGEN PLANT
11. BLAST FURNACES
12. STEELMAKING AND CASTING
13. HOT STRIP MILL
14. STRIP FINISHING
15. PLATE MILL

FIGURE 4–51 ISOPLETHS OF SO_2 CONTRIBUTIONS FROM THE PROPOSED LAKEFRONT PLANT USING 1973 METEOROLOGICAL DATA IN CDM ($\mu g/m^3$)



- - - - - - PROPERTY LINES
1. COAL STORAGE
2. COAL BLENDING
3. COKE OVENS
4. COKE OVEN BY-PRODUCTS PLANT
5. MAINTENANCE SHOPS
6. RAW MATERIAL STORAGE
7. POWER HOUSE
8. SINTER PLANT
9. WATER INTAKE AND TREATMENT
10. OXYGEN PLANT
11. BLAST FURNACES
12. STEELMAKING AND CASTING
13. HOT STRIP MILL
14. STRIP FINISHING
15. PLATE MILL

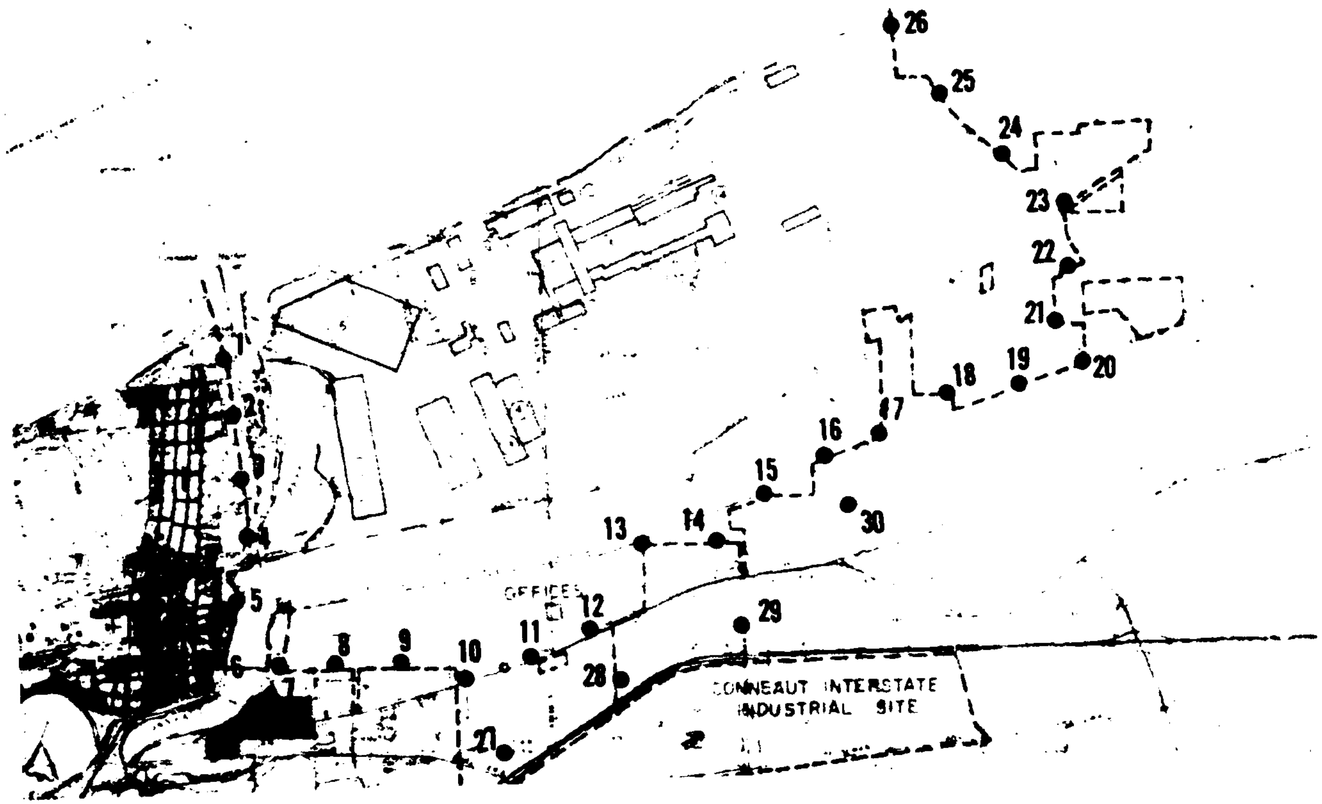
FIGURE 4–52 ISOPLETHS OF SO_2 CONTRIBUTIONS FROM THE PROPOSED LAKEFRONT PLANT USING 1972 METEOROLOGICAL DATA IN CDM ($\mu g/m^3$)

deterioration, which is 20 ug/m^3 (annual arithmetic average). Based on the monitor data at the proposed site, the average ambient SO_2 concentraion is 35 ug/m^3. The additional five ug/m^3 from the proposed plant would not cause the resultant ambient levels to approach the annual standard of 80 ug/m^3.

Short-Term Particulate Impacts

4.470
A statistical analysis of the results of the modeling indicates that the short-term Prevention of Significant Deterioration (PSD) increment and the secondary standard for particulates will be met. The short-term particulate impacts were determined by utilizing the series of programs developed by the EPA entitled RAM (Real Time Air Quality Simulation Model). RAM is a short-term (one hour to one day) algorithm for estimating air quality from point and area sources. The algorithm is based on the assumptions of steady-state Gaussian dispersion. The hourly meteorological data for 1976 from Erie Airport were utilized in the RAMMET preprocessor, which were obtained from the National Climatic Center. Twice a day radiosonde readings from Bufalo Airport were obtained to interpolate hourly mixing heights. RAMMET was used to determine the hourly meteorological data for wind direction, wind speed, temperature, stability class, and mixing height based on the raw data. This information was written on a data file with one record per day for the entire year. The output of the RAMMET program is required input to the RAMF program for calculating hourly concentrations.

4.471
A short-term (24-hour average) emissions inventory for the proposed plant was generated by converting the annual rates to short-term maximum design operating conditions. This inventory is presented in Table 1-24. As in the annual inventory, the rationale and reference for each emission rate is indicated in the table. In the section on abnormal operations, the statistical and impact analysis of malfunctions is treated. The inventory as determined from Table 1-24 was utilized in the program RAMF to determine the hourly and 24-hour average particulate concentrations for a series of receptors at the property line perimeter. A group of 30 receptors surrounding the site separated by approximately 500 meters was chosen to determine the maximum ambient concentrations for the entire year. Preliminary computer runs of the program PTMAX for determining the location of the maximum ground level concentrations indicated that the closest property line receptors would produce the highest concentrations. The nearest source to receptor distance was approximately one kilometer. Therefore, the 30 receptors chosen for the running of RAMF were on the plant boundaries as shown in Figure 4-53. RAMF was run for the 30 receptors based on the hourly meteorological data from RAMMET.



Property Lines

1. Coal Storage
2. Coal Blending
3. Coke Ovens
4. Coke Oven By-Products Plant
5. Maintenance Shop
6. Raw Material Storage
7. Power House
8. Sinter Plant
9. Water Intake and Treatment
10. Oxygen Plant
11. Blast Furnaces
12. Steelmaking & Casting
13. Hot Strip Mill
14. Strip Finishing
15. Plate Mill

FIGURE 4–53 RECEPTOR LOCATIONS 1 THROUGH 30 FOR RAMF

4.472
The ambient concentrations of the eight receptors showing the highest concentrations for the entire year are indicated in Table 4-269. It is apparent from the table that all but one of the highest concentrations were receptors located west of the plant. Examination of the worst case meteorological days (62 and 153) indicates a persistent east wind during these intervals. Day 62 is part of a four-day episode (1-4 March) characterized by an almost stationary warm front along the southern edge of Lake Erie. Temperature soundings at Buffalo show warm air overrunning the cool surface air. This was an extremely stable synoptic situation. Surface winds were extremely persistent over the four-day period. The overrunning warm air limited the mixing during the episode to approximately 400 meters. The day 153 episode (1 June) was characterized by the passing of a cold front with surface temperatures dropping the entire day. Despite overcast conditions, it appears that an advective fumigation existed as the cold air moved across the cold lake water onto the land which had been warmed over the previous few days. The cold air overrode a warm layer that was approximately 350 meters deep. An intense radiational inversion had developed. This again was a case of limited mixing associated with a synoptic weather system.

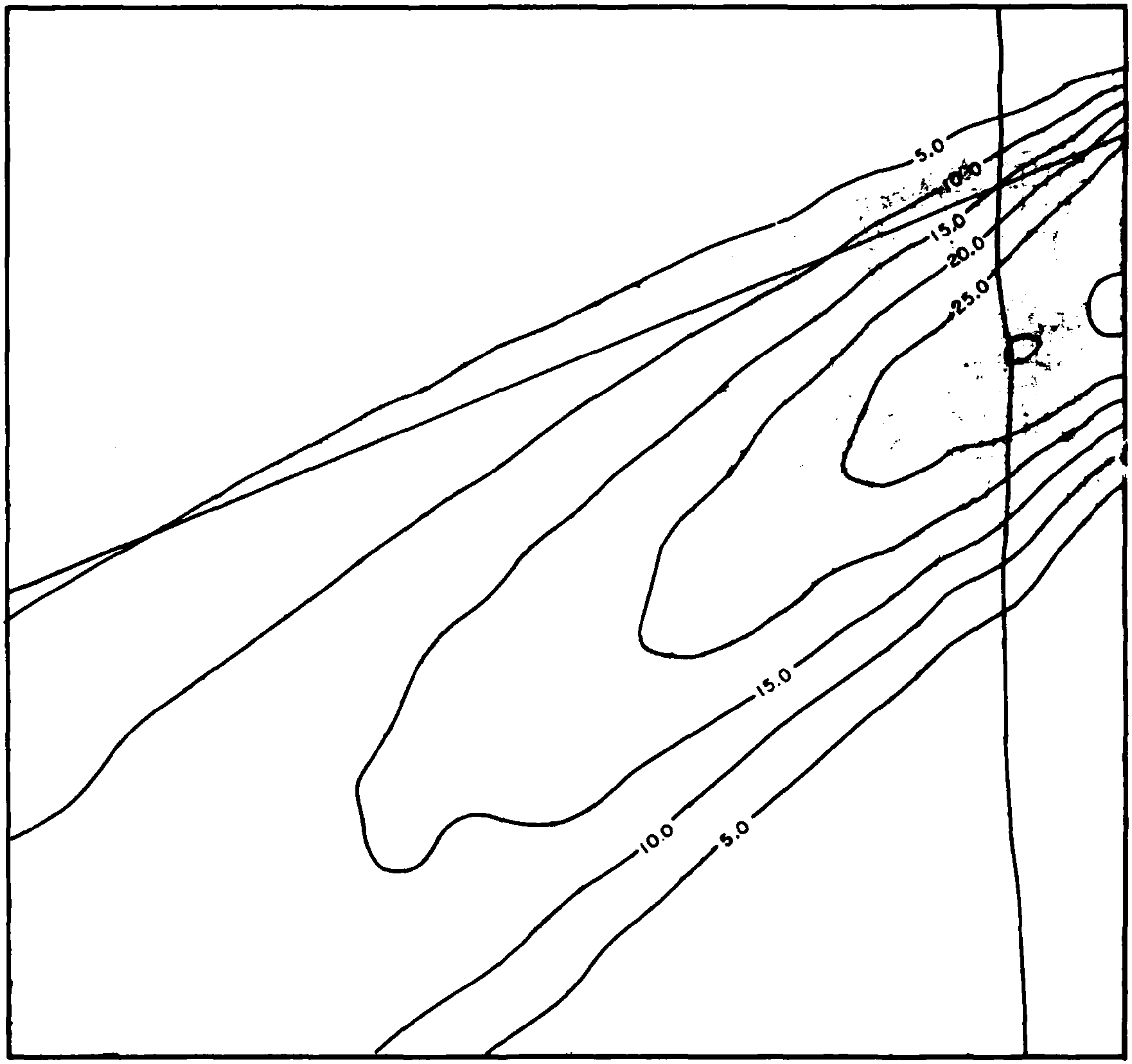
4.473
Based on the RAMF runs, the principal situations that cause maximum particulate concentrations are the combination of a persistent wind with limited mixing height for the nearest receptors. This causes the greatest impact on receptors bordering the west side of the site. An isopleth plot showing the regional impact on Conneaut for the worst case day is shown in Figure 4-54. A general analysis describing the results of RAMF can be described by generating a particulate pollution rise. The compass was divided into 20-degree sectors starting at zero. Then, based on the prevalent wind direction for the day, the high receptor reading was assigned to one of the 18 directions. After the receptor readings for the entire year were assigned, the readings within a class were sorted from lowest to highest. The median daily high receptor reading was chosen for each direction and plotted on the Particulate Pollution Rose (refer to Figure 4-55). This figure shows the influence of east-northeast winds on short-term concentration impacts.

4.474
The maximum concentration at receptor No. 4 (30 ug/m^3) indicated that the prevention of significant deterioration regulation of 37 ug/m^3 will be met. Based on the air quality data for 1976 for Conneaut, the prevalence of east or north winds produces background levels that are relatively low. During these conditions, particulate levels are less than 60 ug/m^3. Therefore, the proposed plant contribution plus the background would be less than the secondary

Table 4-269

Summary of RAMF Output for Particulates

Julian Day	Receptor No.	Concentration ($\mu g/m^3$)
62	4	29.99
146	11	29.30
62	5	29.16
62	3	28.82
153	4	28.35
153	5	26.46
62	2	26.11
153	3	25.49



Source: RAM Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates.

FIGURE 4–54 ISOPLETH PLOT FOR INCREMENTAL PARTICULATE CONCENTRATIONS FROM THE PROPOSED LAKEFRONT PLANT FOR DAY 62 ($\mu g/m^3$)

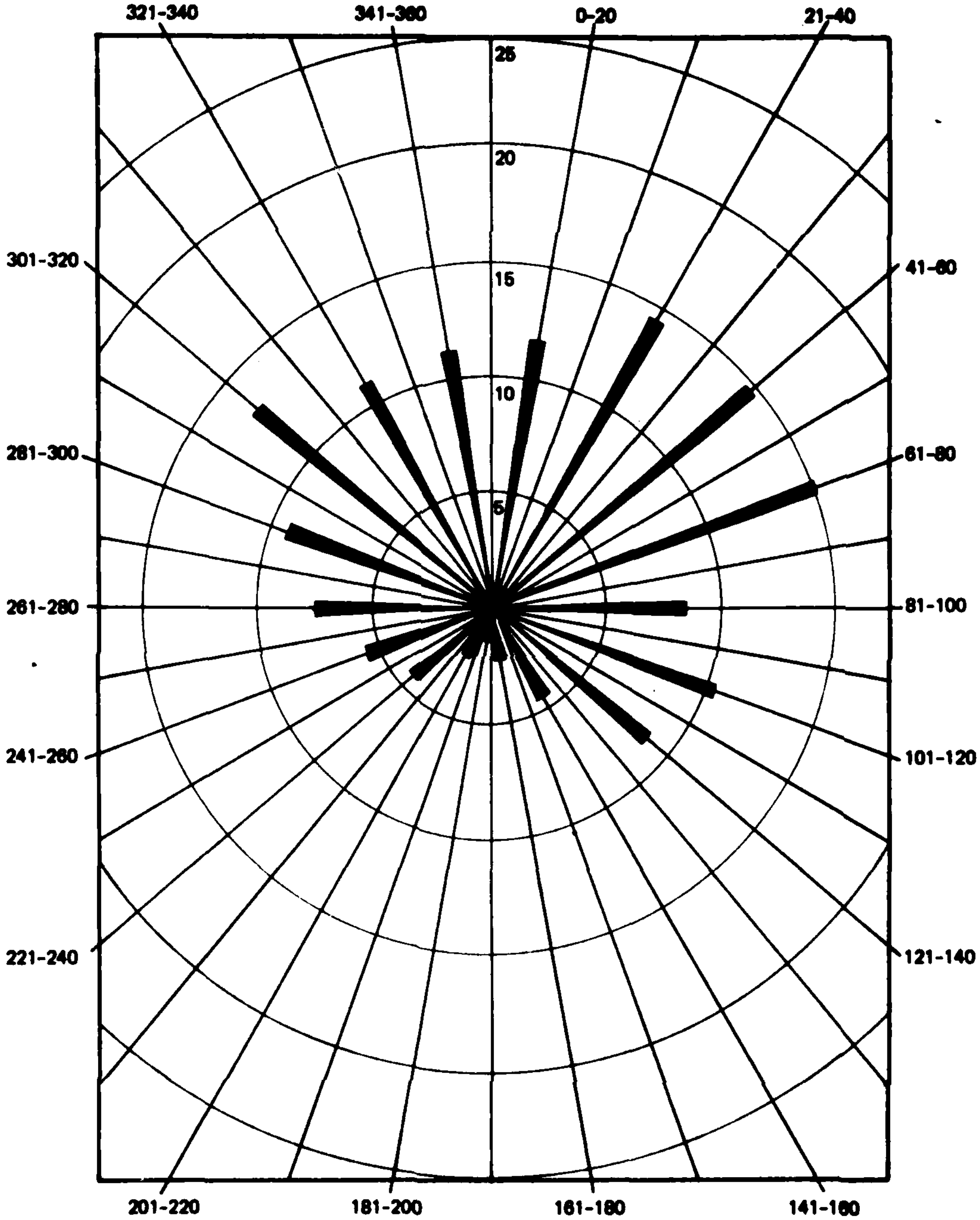


FIGURE 4–55 MEDIAN HIGH RECEPTOR READING 20° SEGMENTS ($\mu g/m^3$)

standard of 150 ug/m^3. If the second highest level for 1976 was utilized as the maximum background with respect to the standard, this value would be 129 ug/m^3, which was recorded on Julian day 127. However the RAMF output on this same day produced a maximum value of 15 ug/m^3. This results in an expected high of 144 ug/m^3. The cumulative frequency distributions of receptors No. 4 and No. 5, the two receptors with the highest single day readings, were recorded and calculated. Although each receptor showed some high particulate levels, the majority of their readings were zero. Each receptor had over 60 percent of its daily readings equal to zero and about 70 percent less than 1 ug/m^3. The 95 percent point for receptor No. 4 was at 14 ug/m^3 and for receptor No. 5 at 12 ug/m^3. The 99 percent points were 22 and 20 ug/m^3, respectively. The distribution of the receptor readings could then be described as a high spike at zero with a small tail trailing off to the right. Due to the preponderance of zero values in the distribution of receptor readings, no effort was made to fit a theoretical distribution. The values for the frequency distribution are presented in Table 4-270. A histogram of the prevalent wind direction was constructed based on the data used for the Particulate Pollution Rose. The number of days the prevalent wind direction came from each sector was counted and displayed in the histogram (shown in Figure 4-56).

4.475
A cumulative frequency distribution was constructed for the maximum receptor value. A histogram showing the frequency of the maximum daily receptor readings in 1 ug/m^3 was then drawn from the counts in the distribution. Superimposed on the frequency histogram is the cumulative distribution function showing the percentage of days having a receptor reading less than or equal to a specific level. Based on the frequency distribution, it was estimated that 50 percent of the days would produce values less than 7 ug/m^3 and 95 percent of the days the levels would be less than 20 ug/m^3.

4.476
An inspection of the RAMF output for the entire year indicates that on day 163 the impact of the proposed plant on the city of Erie would be the greatest. The maximum property line increment of this day was 18 ug/m^3 at the receptor number 24. The increment in Erie was approximately 2 ug/m^3. This value can be considered as an upper limit since it is assumed that the wind direction would maintain the same persistence over the entire advective distance of 30 kilometers. The wind persistence calculated for this day was 0.88 indicating an unrealistically high value for the entire length. The low afternoon mixing height as developed by RAMMET would also not exist over the entire distance. Consequently, the estimated 2 ug/m^3 can be expected to be overly conservative. The impact on the city of Erie would therefore be extremely small.

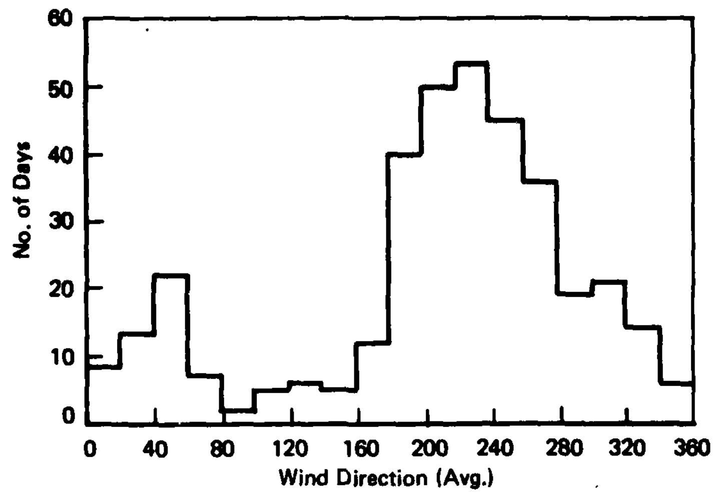
Table 4-270

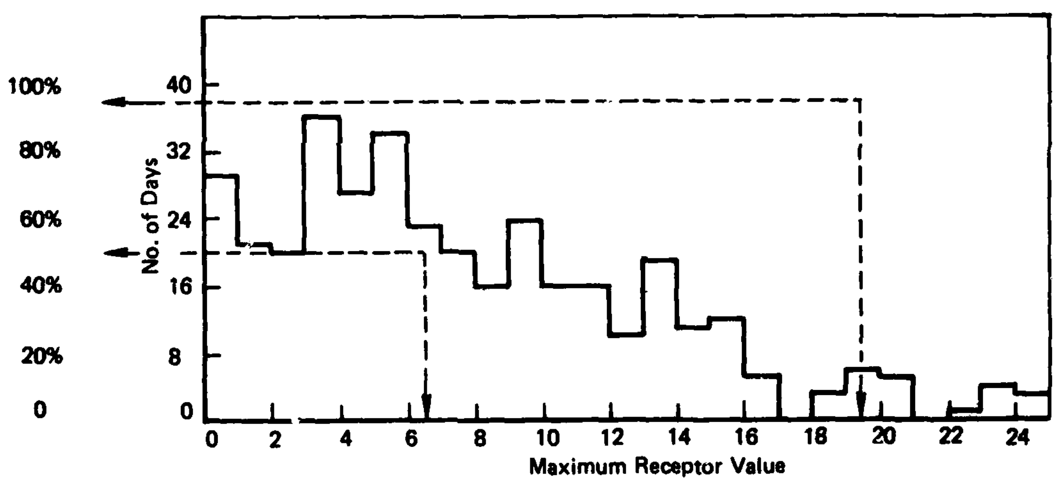
24-Hour Average Particulate Summary Concentration
(Micrograms per Cubic Meter)

Frequency: Jan. - Dec. (Day 1 - 366)

	Receptor No. 4			Receptor No. 5		
	No. of Obs.	Cum. No.	Cum. Percent	No. of Obs.	Cum. No.	Cum. Percent
0	224	224	61.2%	225	225	61.5%
.01 - 1.0	32	256	69.9	36	261	71.3
1.01 - 2.0	15	271	74.0	11	272	74.3
2.01 - 3.0	10	281	76.8	17	289	79.0
3.01 - 4.0	10	291	79.5	16	305	83.3
4.01 - 5.0	11	302	82.5	12	317	86.6
5.01 - 6.0	12	314	85.8	7	324	88.5
6.01 - 7.0	6	320	87.4	3	327	89.3
7.01 - 8.0	4	324	88.5	3	330	90.2
8.01 - 9.0	3	327	89.3	5	335	91.5
9.01 - 10.0	4	331	90.4	6	341	93.2
10.01 - 11.0	5	336	91.8	4	345	94.3
11.01 - 12.0	6	342	93.4	5	350	95.6
12.01 - 13.0	1	343	93.7	4	354	96.7
13.01 - 14.0	7	350	95.6	5	359	98.1
14.01 - 15.0	3	353	96.4	1	360	98.4
15.01 - 16.0	2	355	97.0	1	361	98.6
16.01 - 17.0	-	-	-	-	-	-
17.01 - 18.0	2	357	97.5	-	-	-
18.01 - 19.0	1	358	97.8	1	362	98.9
19.01 - 20.0	2	360	98.4	1	363	99.2
20.01 - 21.0	1	361	98.6	-	-	-
21.01 - 22.0	2	363	99.2	1	364	99.5
22.01 - 23.0	-	-	-	-	-	-
23.01 - 24.0	1	364	99.5	-	-	-
24.01 - 25.0	-	-	-	-	-	-
25.01 - 26.0	-	-	-	-	-	-
26.01 - 27.0	-	-	-	1	365	99.7
27.01 - 28.0	-	-	-	-	-	-
28.01 - 29.0	1	365	99.7	-	-	-
29.01 - 30.0	1	366	100.0%	1	366	100.0%

Source: RAMF output (simulator based on 1976 Meteorology).





50% of Days < 6.5 $\mu g/m^3$
95% of Days < 19.5 $\mu g/m^3$

FIGURE 4–56 HISTOGRAMS FOR WIND DIRECTION AND MAXIMUM RECEPTOR VALUES

Short-Term Sulfur Dioxide Impacts

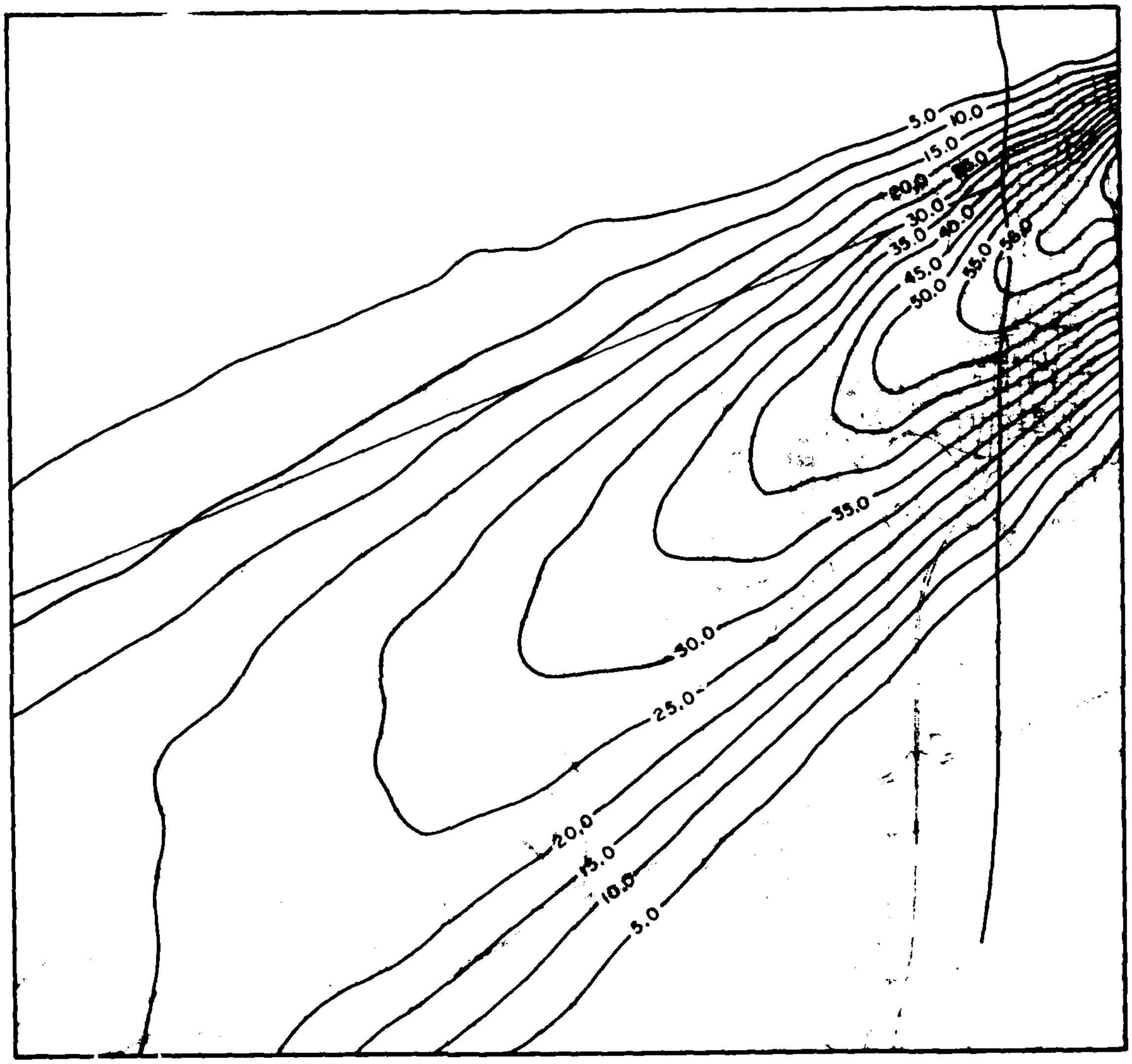
4.477
The sulfur dioxide sources are not greatly different than particulates in the emission characteristics, as is shown by the same worst case receptors on the same worst case meteorological days. Statistical analysis of the sulfur dioxide results would therefore not reveal any major differences than the particulate analysis. Since the background levels are significantly lower, the impact of the plant on total ambient sulfur dioxide concentrations would be less than the secondary standard. The short-term incremental increases of ambient sulfur dioxide must be related to the maximum three-hour average and the maximum 24-hour average. The 24-hour average was again determined from the program RAMF using the emissions inventory obtained from Table 1-24. A summary of the results for the top eight receptors presented in Table 4-271 indicates a maximum level of 83 ug/m^3 on day 61. All of the maximum receptors again are the result of east winds and impact receptors bordering the western side of the plant. This maximum level is less than the allowed PSD increment of 91 ug/m^3. Examination of the baseline sulfur dioxide monitor levels indicates that the maximum 24-hour ambient level was 106 ug/m^3. Therefore, the combined ambient and plant increment will not violate the 24-hour standard of 365 ug/m^3. The impact of SO_2 emissions on the Conneaut area for a typical worst case day is shown by the isopleth plot in Figure 4-57. Examination of the RAMF output indicates that for the city of Erie the maximum incremental increase would occur on day 163 as in the particulate analysis. This increase was calculated to be 3 ug/m^3. This level is expected to be conservative for the same reasons as noted in the particulate analysis.

4.478
The effect of lake breeze fumigation on maximum sulfur dioxide concentrations was examined by utilizing the computer program AQTSM. The air quality impact of lake breeze fumigation was analysed by combining hourly output from AQSTM (fumigation hours) and RAM (nonfumigation hours) to develop a 24-hour average concentration at receptors of expected high impact (Nos. 9, 10, 11, 12, and 13 in RAM notation). Real time data for six days in 1976, were chosen for this analysis, namely, Julian days 146, 147, 148, 214, 228, and 229. These days were chosen for their potential lake breeze meteorology (i.e., light, midday on-shore winds with clear to only partly cloudy sky conditions). The resulting 24-hour average concentration are presented in Table 4-272. As the data in this table illustrate, the worst case day was found to occur on Julian day No. 146, with a high concentration of 54 ug/m^3 at receptor No. 11. Further investigation on this day reveals that lake breeze fumigation was not the primary cause of this high value. The highest hourly concentrations

Table 4-271

24-Hour Average SO_2 Concentration Increases from RAMF Output

Julian Day	Receptor	Concentration ($\mu g/m^3$)
61	3	83
220	3	76
61	4	71
260	3	67
62	2	67
62	3	65
153	3	59
237	2	59



Source: RAM Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates.

FIGURE 4–57 ISOPLETH PLOT FOR INCREMENTAL SO_2 CONCENTRATION FROM THE PROPOSED LAKEFRONT PLANT FOR DAY 62 ($\mu g/m^3$)

Table 4-272

RAM-AQSTM Worst Case 24-Hour Average for SO_2[1]
(ug/m^3)

Day	Receptor No.[2]				
	9	10	11	12	13
146	22	33	54	22	16
147	10	7	11	20	26
148	4	4	7	14	10
214	21	19	19	28	16
228	0	1	9	16	43
229	0	0	6	48	37

(1) Allowed PSD increment is 92 $\mu g/m^3$.

(2) Receptor numbers refer to Figure 4-57.

during this day resulted instead from steady, light winds in the evening hours. An hourly high of 541 ug/m^3 occurred during hour 20 as a result of a 1.0 meters per second wind and a stable mixing layer.

4.479
The highest three-hour sulfur dioxide concentration on day 146 occurred during hours 19 through 21. The nonfumigation hours produced concentrations of 104, 536, and 339 ug/m^3 at receptor No. 11 giving a three-hour average of 326 ug/m^3. By comparison, the highest three-hour average during the fumigation period (hours 16-18) occurred at receptor No. 12 and had a value of 92 ug/m^3. Since these values are lower than the allowed PSD three-hour level of 512 ug/m^3, no period during the days considered exceeded the three-hour SO_2 standard. The analysis of hourly and three-hour average concentrations indicates that high evening sulfur dioxide levels were the major factors responsible for the high values on this day. Although lake breeze fumigation was not a significant factor on this particular day, it could be significant on other days, especially on warm days in late spring and early summer. The applicant's consultant feels that lake breeze fumigation is not a critical incident in the proposed plant air quality analysis.

b) Impacts of Other Pollutants

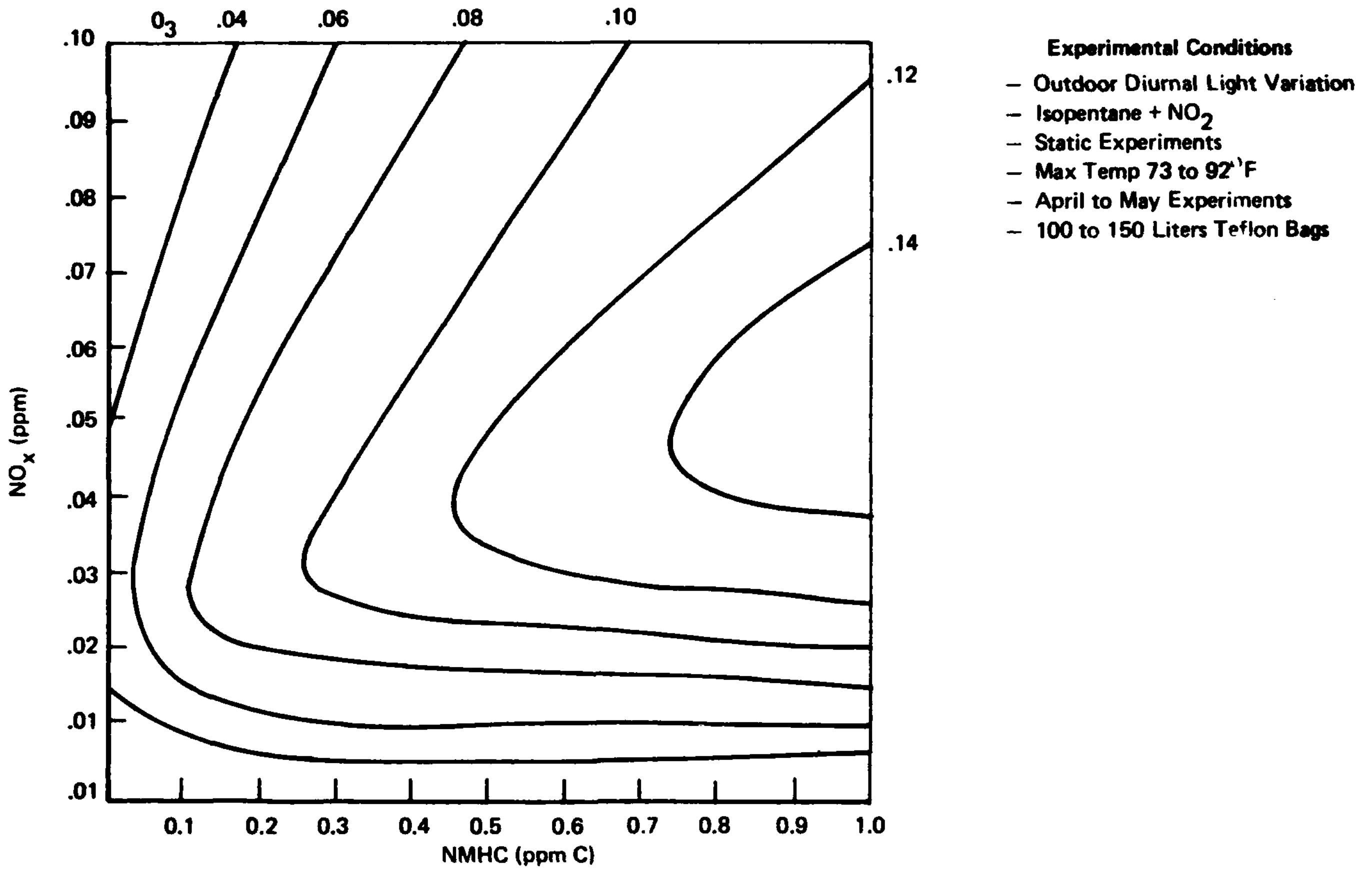
Hydrocarbons Oxidants

4.480
The projected change in hydrocarbon emissions for the Regional Study Area would lead to an increase of six percent, while NO_x emissions are expected to increase by 26 percent. Although it is not possible to accurately estimate the resultant change in oxidant levels, a simple model indicates that the change would be negligible. The construction and operation of the proposed Lakefront Plant and the anticipated secondary development accompanying the project would lead to emissions of volatile hydrocarbons and oxides of nitrogen. These atmospheric contaminants are known to interact via photochemical reactions in the atmosphere to produce ozone which is a dominant oxidant or oxidizing agent in the atmosphere. Thus, it is important to investigate the possible impact of these emissions on oxidant air quality.

4.481
Although it is well known that atmospheric hydrocarbons and nitrogen oxides are involved in the atmospheric production of ozone, the details of the atmospheric processes are only poorly understood. Many chemical reactions have been identified as being involved in the

process but the reaction rates are not well known under all environment conditions. Vertical transport from upper layers of the atmosphere has been shown to be an important factor in some high ozone concentration episodes but adequate data on vertical transport are not routinely available. Long range transport of oxidants and the oxidant precursors (nonmethane hydrocarbons and nitrogen oxides) have been demonstrated to be important (4-7, 8) but long-range transport is extremely difficult to estimate, either in retrospect or in forecast. Long-range transport is probably responsible, in part, for the regional nature of high oxidant levels and for elevated levels found in some rural areas, hundreds of miles from pollution sources. Under such conditions, high ozone levels occur simultaneously over thousands of square miles during episodes of stagnant air flow, which usually occur on the trailing edge of high pressure systems. (4-8) These meteorological conditions will generally be accompanied by southwest winds, sunny skies, and subsidiary air flow. All of these factors would appear to be conducive to high oxidant levels, especially in location northeast of major sources (cities). Consequently, it is difficult to delineate between the competing processes of long-range transport, vertical transport, and photochemical reactions in the atmosphere, and the current state of knowledge does not permit accurate assessment of the effect of a given source of precursors on local or regional oxidant levels. One of the simplest methods for estimating the effect of a change in precursor emissions on oxidant levels is the proportional model, whereby oxidant levels are presumed to vary in proportion to the regional emissions of nonmethane hydrocarbons (NMHC). The proportional model has been used across the United States in the development of State implementation plans for the control of oxidant air quality. A further level of sophistication is provided by employing the proportional model to estimate changes in the ambient concentrations of NMHC and nitrogen oxides (NO_x) and then estimating oxidant levels by the oxidant isopleth method. (4-9) This is based on laboratory experiments where a mixture of HC and NO_x similar to that found in a polluted atmosphere is exposed to controlled levels of light and resulting concentrations of ozone/oxidants are determined. It is found that the resultant oxidant concentration vary in a complicated, but reproducible, way with NMHC and NO_x. An example of the shape of ozone isopleth vs. NMHC and NO_x is shown in Figure 4-58. (4-10)

4.482
Ambient sampling of air quality at the project site reveals that the National Ambient Air Quality Standards for ozone (0.08 ppm, one hour average) is regularly exceeded at the proposed site. The daily peak ozone concentration was exceeded at one or both of the ERT stations on 48 days during the five months of April through August of 1977. High ozone days are well correlated with southwest winds -- winds from the 10 hours preceeding each peak of more than 0.08 ppm were



Source: United States Environmental Protection Agency.

FIGURE 4–58 OZONE VERSUS INITIAL PRECURSOR LEVELS – "AGED" PRECURSOR MIX

from the southwest quadrant over 50 percent of the time. However, this fact does not allow for the possibility that long-range transport from Cleveland, Youngstown, Cincinnati, or Detroit may be responsible for high oxidant levels. It is perhaps more important that southwest winds result from slow-moving high pressure systems, in which the precursors and oxidants have been trapped near ground level for several days with adequate sunlight to initiate the photochemical reactions necessary for the production of ozone. Ozone levels were found to peak daily between hours 15 and 17 late afternoon as expected on the basis of the photochemistry. If long-range transport were the sole explanation of high ozone concentrations at the project site, one would expect peaks at anomalous (late evening or nighttime) hours as reported by Lyons and Cole (4-11) on the Lake Michigan coast.

4.483
Ambient concentrations of the precursors NMHC, NO_x, and NO_2 have been monitored since April 1977, and it is found that NO_x concentrations average 0.023 ppm at the Rte. 20 site and 0.013 at the Lynch Road site which is farther from a major traffic route. These levels of NO_x are typical of suburban locations across the U. S. (4-9) NMHC, concentrations on the other hand, average about 0.05 ppm which is indicative of a highly unpolluted rural environment. (4-9) These differences between relative contamination by NMHC and NO_x may be explained by the existence of a large local source of NO_x, the Ashtabula power plant, west-southwest of the project site. However, cursory examination of the hourly data did not reveal a strong correlation of high NO_x with WSW winds. The ratio of NMHC to NO_x is thought to be an important parameter in determining the resultant oxidant concentration (4-9), and in estimating the effect of a given change in precursor concentration on the ambient oxidant levels. That ratio is found to be generally less than 10:1 at the proposed site. Rural sites generally exhibit a ratio of greater than 30:1, and thus the observed ratio is unexpectedly low. This would seem to result from the extremely low NMHC levels recorded at the site, and is not indicative, in this case, of a polluted atmosphere. The high levels of ozone experienced at the project site are not unexpected in the light of similar recent findings at several rural sites in the U.S. (4-12, 13). Based on available data and the current state of understanding of atmospheric ozone, it is impossible to determine the sources of these high concentrations.

4.484
Due to the number of uncertainties associated with comprehension of the baseline ozone problem, it is difficult to estimate the impact of the proposed project. The technique used is to estimate changes in precursor concentrations by a proportional model, (i.e., it is assumed that changes in NMHC and NO_x air quality are proportional

to changes in regional emissions). Then changes in ozone concentration are estimated by the ozone isopleth method. The size of the region to be included in the proportional model is crucial to the final results. This can be seen by the equation which forms the basis for the proportional model.

$$\frac{X_1}{X_0} = \frac{E_1}{E_0}$$

where X_0 and E_0 are the baseline precursor concentration and regional emission rate, respectively; and X_1 and E_1 are the precursor concentration and regional emission rate in some future year if the project were implemented.

4.485
If the region chosen is large enough, then E_0 will be very large, and the impact of any proposed change will appear small. By choosing too small a region the impact of the proposed change will be overstated. For the purpose of this study, the regional air basin is defined as Ashtabula County, OH, and Erie and Crawford Counties in Pennsylvania. This region encompasses most of the area within 40 miles of the proposed project site. Based on recent findings of long-range transport up to hundreds of miles, this region is probably too small to encompass all the sources which affect air quality at the project site, but as such it is a conservative choice which should lead to a slight overstatement of potential impact. Projected emissions of hydrocarbons and nitrogen oxides for the Regional Study Area are shown in Tables 4-272 through 4-276. Within this Regional Study Area, emissions inventories have been obtained for both point and area sources of hydrocarbons and NO_2. Emissions are routinely reported for these parameters, and it is assumed that these emissions are linearly related to NMHC, and NO_x emissions, respectively. Area source emissions for Erie and Crawford Counties have not been compiled by the Commonwealth of Pennsylvania, so it was assumed that the area source (i.e., small source) emissions were proportional to population, and per capita emissions were estimated from several neighboring counties in Ohio. The baseline emissions inventories (1975) are also shown in Tables 4-273 and 4-276.

4.486
The SIMPACT IV Model, was used to estimate changes in emissions engendered by secondary development expected to accompany the plant. Socioeconomic considerations were used to project population changes in various townships. These estimates were used to estimate changes in vehicle miles traveled and space heating leading to an estimate of pollutant emissions. Baseline population changes (changes which would occur without the project) are included in estimates of future emissions via the same per capita emissions experienced in the base

Table 4-273

Projected Changes in Hydrocarbon Emissions in the Regional Study Area (Metric Tons)

	1980			1985			1990		
	Constr	Oper	Total	Constr	Oper	Total	Constr	Oper	Total
1. Fuel Oil									
Ohio	0.4	0.	0.4	0.2	1.6	1.8	0.	2.8	2.8
Pennsylvania	0.4	0.	0.4	0.2	0.4	0.6	0.	0.8	0.8
2. Passenger Auto									
Ohio	60.5	0.	60.5	16.7	52.4	69.2	0.	52.5	52.5
Pennsylvania	147.1	0.	147.1	35.6	65.2	100.8	0.	59.5	59.5
3. Light Duty Gas Truck									
Ohio	11.8	0.	11.8	4.6	16.6	21.2	0.	19 9	19.9
Pennsylvania	19.6	0.	19.6	7.2	20.6	27.8	0.	22.6	22.6
4. Heavy Duty Gas Truck									
Ohio	10.9	0.	10.9	4.4	15.8	20.3	0.	19.7	19.7
Pennsylvania	18.2	0.	18.2	6.9	19.7	26.6	0.	22.3	22.3
5. Diesel Truck									
Ohio	3.4	0.	3.4	2.1	20.0	22.0	0.	38.2	38.2
Pennsylvania	5.1	0.	5.1	3.0	10.2	13.2	0.	17.6	17.6
6. Natural Gas									
Ohio	0.2	0.	0.2	0.1	1.2	1.3	0.	1.9	1.9
Pennsylvania	0.5	0.	0.5	0.2	0.9	1.1	0.	1.4	1.4
Change in Emissions Due to Secondary Impact									
Ohio	87.3	0.	87.3	28.1	107.6	135.8	0.	135.0	135.0
Pennsylvania	190.8	0.	190.8	53.1	117.0	170.1	0.	124.2	124.2
TOTAL	278.1	0.	278.1	81.2	224.6	305.9	0.	259.2	259.2

Table 4-274

Hydrocarbon Emissions in the Regional Study Area
(Tonnes)

	1975 Constr	1975 Oper	1975 Total	1980 Constr	1980 Oper	1980 Total	1985 Constr	1985 Oper	1985 Total	1990 Constr	1990 Oper	1990 Total
Baseline Hydrocarbon Emissions												
Ohio			8,162.9			8,262.0			8,324.6			8,288.1
Pennsylvania			19,632.7			20,029.3			20,180.9			20,198.4
Total			27,795.6			28,291.3			28,50[illegible].5			28,486.5
Change in Emissions Due to Secondary Impact												
Ohio				87.3	0	87.3	28.1	107.6	135.8	0	135.0	135.0
Pennsylvania				190.8	0	190.8	53.1	117.0	170.1	0	124.2	214.2
Total				278.1	0	278.1	81.2	244.6	305.9	0	259.2	259.2
Plant Emissions												
Ohio												
Pennsylvania								1,317.5	1,317.5		1,317.5	1.317.5
Total												
Total Emissions												
Ohio						8,349.3						
Pennsylvania						20,220.1						
Total			27,795.6			28,569.4			30,128.9			30,063.2

Table 4- 275

Projected Changes in NO_x Emissions due to Secondary Impact
in the Regional Study Area
(Metric Tons)

	1980			1985			1990		
	Constr	Oper	Total	Constr	Oper	Total	Constr	Oper	Total
Fuel Oil									
Ohio	7.7	0.	7.7	3.5	29.7	33.2	0.	49.9	49.9
Pennsylvania	6.4	0.	6.4	3.5	7.9	11.4	0.	13.9	13.9
Passenger Automobiles									
Ohio	56.2	0.	56.2	20.1	62.9	83.0	0.	70.0	70.0
Pennsylvania	136.6	0.	136.6	42.7	78.2	120.9	0.	79.3	79.3
Light Duty Gas Truck									
Ohio	8.7	0.	8.7	4.5	16.2	20.7	0.	21.2	21.2
Pennsylvania	14.5	0.	14.5	7.1	20.1	27.2	0.	24.0	24.0
Heavy Duty Gas Truck									
Ohio	7.4	0.	7.4	5.3	19.0	24.3	0.	31.7	31.7
Pennsylvania	12.3	0.	12.3	8.3	23.6	31.9	0.	35.9	35.9
Diesel Trucks									
Ohio	20.9	0.	20.9	12.8	124.2	137.0	0.	237.4	237.4
Pennsylvania	31.6	0.	31.6	18.9	63.2	82.1	0.	109.7	109.7
Natural Gas									
Ohio	2.4	0.	2.4	1.1	12.0	13.1	0.	19.4	19.4
Pennsylvania	4.8	0.	4.8	2.4	8.9	11.3	0.	14.2	14.2
Change in Emissions due to Secondary Impact									
Ohio	103.3	0.	103.3	47.3	264.0	311.3	0.	429.6	429.6
Pennsylvania	206.2	0.	206.2	82.9	201.8	284.8	0.	277.0	277.0
TOTAL	309.5	0.	309.5	130.2	465.9	596.1	0.	706.6	706.6

Table 4- 276

NO_X Emissions in the Regional Study Area
(Tonnes)

	1975			1980			1985			1990		
	Constr	Oper	Total	Constr	Oper	Total	Constr	Oper	Total	Constr	Oper	Total
Baseline NO_x Emissions												
Ohio			16,125.2			16,125.2			16,125.2			16,125.2
Pennsylvania			51,609.3			51,609.3			51,609.3			51,609.3
Total			67,734.5			67,734.5			67,734.5			67,734.5
Change in Emissions due to Secondary Impact												
Ohio				103.3	0	103.3	47.3	264.0	311.3	0	429.6	429.6
Pennsylvania				206.2	0	206.2	82.9	201.9	284.8	0	277.0	277.0
Total			--	309.5	0	309.5	130.2	465.9	596.1	0	706.6	706.6
Plant Emissions												
Ohio								11,680.0	11,680.0		11,680.0	11,680.0
Pennsylvania								5,300.0	5,300.0		5,300.0	5,300.0
Total			--					16,980.0	16,980.0		16,980.0	16,980.0
Total Emissions												
Ohio			16,125.2			16,228.5			28,116.5			28,234.8
Pennsylvania			51,609.3			51,815.5			57,194.1			57,186.3
Total			67,734.5			68,044.0			85,310.6			85,421.1

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year. Primary emissions by the plant are added to the contributions to arrive at estimates of future emissions for the Regional Study Area, as shown in Tables 4-273 through 4-276.

4.487
Hydrocarbons emissions in the three county region are projected to increase by eight percent in 1985 (the year of maximum impact) over 1975 emissions. The impact of the proposed project over projected 1985 baseline conditions is a six percent increase. Applying the proportional model, an eight percent increase in NMHC over 1975 levels (0.004 ppm) is projected. A change of this magnitude is insignificant, and would probably not be distinguished by monitoring data.

4.488
Emissions of NO_x in the Regional Study Area are projected to rise by 26 percent in 1985 and 1990 with all of it coming from primary and secondary development associated with the project. Baseline emissions of NO_x are presumed to remain unchanged, neglecting the increases associated with greater population and decreases expected from NO_x emission rates from automobiles. Ambient monitoring data indicate that maximum hourly NO_x values at Rt. 20 are 0.14 ppm; and at Lynch Road is 0.05 ppm. Maximum NMHC recorded (1,400 hourly observations) was 0.2 ppm. The data contained in Figure 4-58 show that a significant increase of NO_x, while NMHC is relatively unchanged, would result in a decrease in ozone concentration at this range of precursor levels. However, at typical values of NO_x (0.015 ppm) and NMHC (0.05 ppm); a 26 percent increase of NO_x to 0.019 ppm would result in a slight increase in oxidant. Thus, there is an indication that, under certain conditions, the impact of the proposed plant will be to reduce local ozone concentrations during ozone "episodes" but to slightly increase average concentrations during typical, subcritical conditions. These results must be taken as very rough indications of the impact of the proposed plant. The crude nature of estimation may only warrant the simplest analysis -- the proportional model relating oxidant to hydrocarbon emissions. Based on the projection, that the change in hydrocarbon emissions would be an increase of six percent, then the oxidant levels would increase by less than six percent (after consideration is made for uncontrollable background levels) (refer to Table 4-274). An increase of this magnitude would be too small to be detected in comparison with other natural and man-induced fluctations.

Nitrogen Oxide Impacts

4.489
Fuel combustion involving stationary sources and vehicular emissions account for the major portions of nitrogen oxides (NO_x) in the

Regional Study Area. The measured levels of NO_x are expressed as nitrogen dioxide (NO_2), since in the air nitric oxide (NO) is rapidly oxidized by atmospheric ozone and photochemical processes (and more slowly by oxygen) to form NO_2. The mean residence time of NO in air is five days. Monitoring of NO_2 levels at the two sites indicates an average concentration of 20 ug/m^3. Maximum concentrations at the boundaries of the proposed site, as predicted by the Modified Climatological Dispersion Model (MCDM) are 4 ug/m^3. Consequently, the impacted NO_2 concentration is approximately 24 ug/m^3, which is to be compared to the national standard of 100 ug/m^3 annual arthmetic mean. The inputs to the MCDM for the proposed plant are given in Table 4-277 while an explanation of the source numbers is shown in Table 1-23.

Carbon Monoxide Impacts

4.490
Based on the following analysis, the ambient standard for carbon monoxide would not be violated due to primary operation of the proposed plant. Carbon monoxide emissions at the proposed plant are due principally to the stack emissions at the sinter plant. The short-term maximum emission rate from the sinter exhaust is 11,400 kilograms per hour (refer to Table 1-24). This amounts to 96 percent of the total plant CO emissions including the truck traffic involved in materials movement. Inspection of the RAMF output indicates that the worst case hour occurred on Julian day 146 (hour 20). The maximum one-hour incremental increase of CO during this interval occurred at receptor number 11 due principally to a persistent low speed onshore wind. This value is estimated (for RAMF) to be 14 milligrams per cubic meter (mg/m^3), well below the ambient standard of 40 mg/m^3. Since the measured CO background was low, (less than 8 mg/m^3) it is not expected that the one hour CO standard will be violated. The maximum eight hour concentration occurred on Julian day 62 at receptor number 4 (coordinates 537.3, 4644.5). As in the sulfur dioxide case, this interval was due to a persistent east wind. From RAMF the estimated value is 3 mg/m^3. This increment is again considerably less than the standard of 10 mg/m^3 with the background concentration included. (3 mg/m^3)

Generation of Sulfate Aerosol

4.491
Projected sulfate concentrations downwind of the plant during adverse meteorological conditions may be increased by 1 to 7 ug/m^3 on a 24-hour average compared with background concentrations of 19 to 35 ug/m^3. These meteorological conditions are expected to occur once in a three-year period. On the annual average, increases of 1 ug/m^3 or less are anticipated compared with annual average

Table 4- 277

Projected Plant NO_X Emissions

Source No.	Emission Rate (Kg/Hr)
20	9.4
21	9.4
27	9.0
28	9.0
48	64.1
49	64.1
50	64.1
51	64.1
55	243
65	184
66	184
67	3
68	3
82	26.8
89	38.1
90	38.1
91	38.1
93	38.3
94	38.3
96	1.1
97-101	21.3
Total	1150

Source: Table 1-21.

background sulfate levels. This increase could be offset by the implementation of sulfur dioxide controls in the State of Ohio by 1985. Sulfur dioxide may be oxidized to sulfate aerosol in the atmosphere. There are several possible reactions by which this may occur including photo-oxidation, indirect photo-oxidation involving smog precursors, and metal catalyzed oxidation on particulates or in water droplets. It is likely that all of these processes occur in the atmosphere, but present knowledge of atmospheric chemistry is not sufficient to determine which of these processes predominates or controls the rate of overall oxidation of SO_2. Although numerous experiments have been carried out to determine the rate of oxidation, reported values vary from 0.01 hr^{-1} to 0.5^{-1}. (4-14) It appears from these experiments that the reaction rate may vary with relative humidity, the presence and nature of particulate matter in the plume and the ambient atmosphere, and the presence of photochemical smog and its precursors.

4.492
Most studies have been conducted on well-defined, high stack power plant plumes. The much greater complexity of the plume characteristics for the proposed steel plant, where oil, coal, and coke oven gas will be contributing to SO_2 emissions at several elevations, makes it difficult to apply previous observations to this analysis. However, it it is possible to estimate a range of transformation rates which are not likely to be exceeded in the steel plant plume. *Reported transformation* rates in excess of 0.10 hr^{-1} are restricted to experiments on much more concentrated plumes than expected from this plant or where liquid droplets are present which will be discussed under rainout. Reported transformation rates below 0.01 hr^{-1} are restricted to locations where particulates, relative humidity, and smog precursors were at low levels relative to conditions expected in the steel plant plume. Thus the transformation rate is expected to fall in the range 0.01 to 0.10 hr^{-1} (4-15) Part of the plant emissions of sulfur will be in the form of sulfur trioxide, SO_3, which is hygroscopic and hydrates almost instantaneously to H_2SO_4 in the ambient atmosphere. It is estimated that over 95 percent of the sulfur emission from the plant will be SO_2, but the small amount of SO_3 can be an important contributor of SO_4 in the immediate vicinity of the plant.

4.493
Calculation made by the applicant's consultant show that maximum annual average increases of sulfate will occur in a 70^{o} arc east-northeast of the proposed plant. Maximum annual sulfate changes are expected 30 to 100 kilometers downwind of the plant and will not exceed 0.1 ug/m^3 compared to baseline concentrations of 7-15 ug/m^3. The area of impact approaching 0.1 ug/m^3 is 90,000 km. Due north of the plant, in Canada, the largest changes in annual

sulfate concentrations are anticipated 60-80 km from the plant. In a narrower, 22° arc, annual concentrations of SO_4 may increase by 1.4 ug/m^3, and an arc of 60,000 km may experience an increase of 1.0 ug/m^3 attributable to the new facility. An attempt has been made to estimate worst case sulfate contributions from the proposed plant over a 24 hour period, based on an assumption of unvarying adverse meteorological conditions and maximum plant SO_2 emissions.

4.494
Although Julian day No. 62 was the worst day for SO_2 concentrations, it may not be the worst for sulfate formation, particularly because of the moderate wind speed of five meters per second. At lower wind speeds, the sulfate conversion occurs much closer to the source before the plume is substantially diluted. Thus, a hypothetical worst case has been investigated based on the following meteorological conditions: wind speed 2.5 meters per second; mixing height, 500 meters; a total plant emission rate of 470 grams per second; and D atmospheric stability. A statistical analysis of 1976 meteorological data from Erie indicates that these conditions would occur at most once in a three-year period (95 percent confidence). For these meteorological conditions, a conservative estimate of SO_4 concentrations can be obtained by assuming a low deposition velocity of 0.8 centimeters per second (cm/sec), and a high transformation rate of 0.1/hr. On the other hand, a lower bound can be estimated by assuming a high SO_2 deposition velocity of 2.0 cm/sec, and a low transformation rate of 0.01/hr. These two cases yield a range of sulfate concentrations under "hypothetical worst case" meteorological conditions of 1 to 7 ug/m^3. The variation of SO_x concentration with downwind distance from the plant for day 62 and the "hypothetical worst case" day is shown in Figure 4-59. The estimates of the plant increment to ambient SO_4 concentrations may be compared with observations in the vicinity of power plant by Tong and Battel (4-16), which find long-term mean upwind-downwind difference observed was roughly 50 ug/m^3. Thus, the SO_4 increments of the plant should be viewed in the context of the regional sources of sulfur oxides. Emissions in the State of Ohio are likely to be reduced significantly under the State implementation plan for control of sulfur oxides. Although some provisions of the plan are currently under litigation, it is likely many of the provisions will be implemented by 1985 and sulfur oxide emissions from Ohio diminished. This change could be modified by the conversion to coal if a national energy plan were adopted in the future.

Removal of Sulfur Oxides by Precipitation

4.495
The removal of sulfur oxides by precipitation has been studied extensively, primarily because sulfate washout has generally been implicated as a major cause of anomalously acidic rainfall, prevalent in

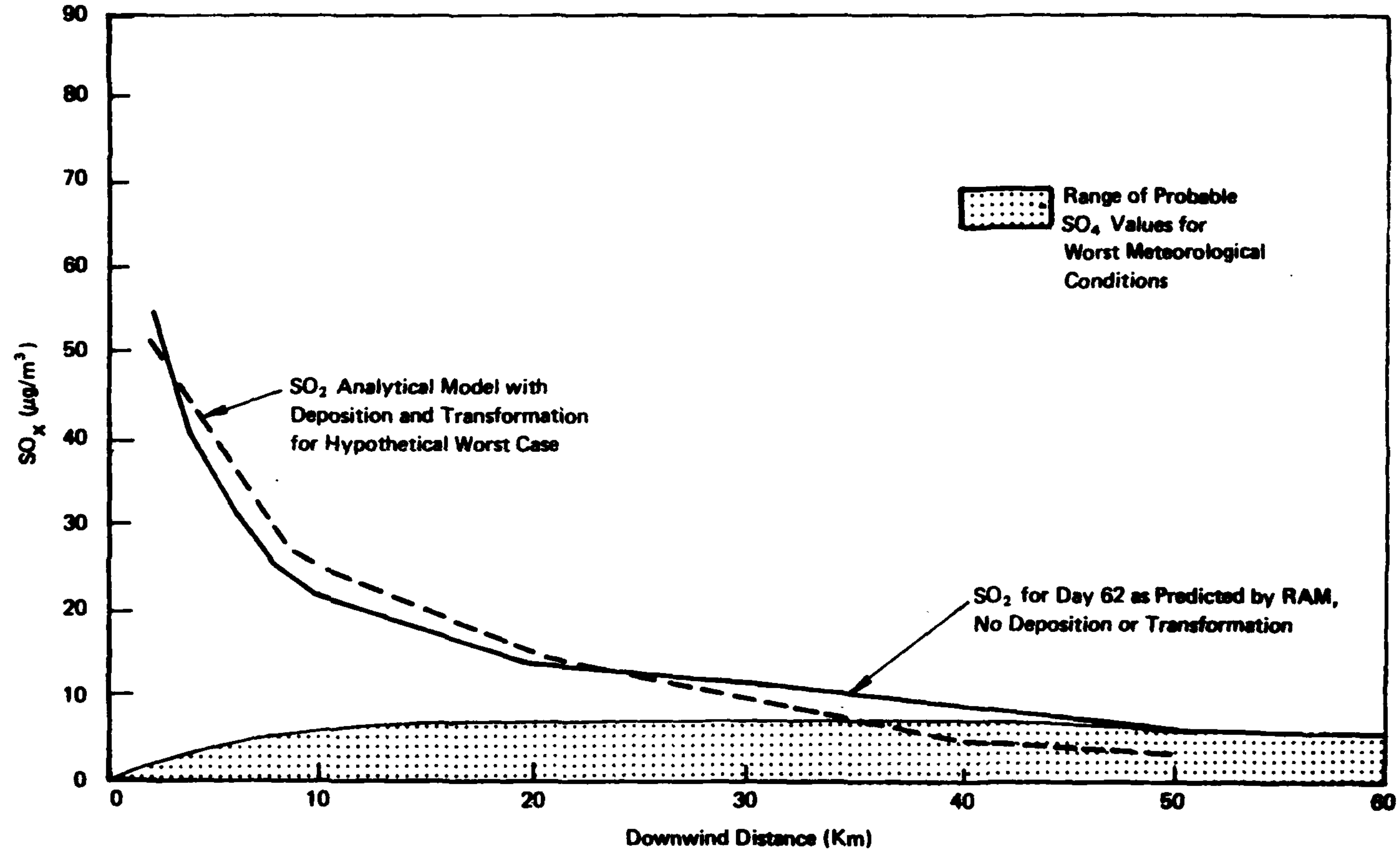


FIGURE 4–59 INCREMENTAL CHANGES IN SO_2 AND SO_4 FOR "WORST CASE" METEOROLOGICAL CONDITIONS

the northeastern United States and northern Europe. Two mechanisms have been identified which lead to elevated levels of sulfate in rain: scavenging of sulfate (SO_4) aerosol or scavenging of sulfur dioxide (SO_2) gas followed by oxidation to sulfate in the raindrop. Scavenging of sulfate aerosol is controlled by the size distribution of the drops in the sulfate aerosol. The scavenging of sulfur dioxide gas, on the other hand, is controlled by the SO_2 solubility in water which exhibits a strong dependence on the pH of the raindrops. The solubility of SO_2 in raindrops is significantly reduced to pH 4.5 (typical of conditions in the vicinity of the plant) vs. pH 5.6 (the pH of rainfall in relatively unpolluted air). Consequently, the relative importance of SO_2 scavenging vs. sulfate aerosol scavenging varies from one location to another, depending on the pH of the rainfall. This dependence has been demonstrated in experiments in the States of Washington (4-17) and Alabama (4-18) where the rainfall pH is 5.4 or greater; and at the Keystone generating plant in western Pennsylvania (4-19) where the background pH was generally less than 5.0. At Keystone, the sulfur dioxide concentration of rainwater collected at the ground after passing through the plume was actually less than the background rainfall. The most plausible explanation is that SO_2 absorption was relatively insignificant at the low pH of the rainfall; washout of sulfate aerosol within the plume reduced the pH even more; after the drops passed through the plume but before they reached the ground, SO_2 was desorbed from the drops to the air which contained substantially less SO_2 than the air within the plume. Evidence for this hypothesis is found in the observed correlation between pH and SO_2 and the negative correlation of SO_4 and SO_2. The low pH of the rainfall passing through the plume was caused by washout of the sulfate aerosol, and probably to a lesser extent by washout of SO_2 which was subsequently oxidized in the drop to sulfate. Rainfall sulfate concentrations were significantly elevated below the plume, while pH was depressed. At the relatively high pH existing in Washington and Alabama, it is found that SO_2 washout is much more prominent. Rain from under the plume exhibited higher concentrations of both SO_2 and sulfate. All of these results can be explained only on the basis of the variation of SO_2 solubility with pH, allowing for reversible absorption/desorption of SO_2 in raindrops.

4.496
The results from the Keystone Plant are most relevant to the assessment of sulfate washout from the proposed plant. The Keystone facility is located only 115 miles from the proposed Lakefront Plant site, in an area of similar atmospheric SO_2 and sulfate concentrations, similar climatic regime, and highly similar rainfall acidity. There are, however, significant differences between the Keystone generating facility and the proposed plant relative to the emission characteristics of SO_2. First, the SO_2 emission rate at

the Keystone plant during the course of the Hales, et al. (4-19) experiments ranged from 2,700 gm/sec to 6,100 gm/sec, averaging 3,500 gm/sec. This emission rate is roughly ten times the rate projected at the Lakefront Plant. Second the SO_2 from the Keystone Plant was emitted from two stacks, both 240 meters high. The SO_2 at the Lakefront Plant would be emitted from 23 stacks ranging in height from 30 to 100 meters. Thus, the Keystone plume is initially much more concentrated in the manner of an ideal point source far above the ground. The Lakefront Plant, however, is a combination of a number of disperse point sources at several elevations much closer to the ground. To an observer, only a few kilometers downwind, it would present the appearance of a broad area source with an effective emission height of roughly 200 meters. The plume will be much more evenly distributed in the vertical and horizontal directions than the Keystone point source and the maximum SO_2 and sulfate concentrations in the center of the plume will be much less than at the Keystone plume centerline.

4.497
Based on the aforementioned similarities and differences between the proposed Lakefront Plant and the Keystone generating facility, the applicant concludes that rainfall sulfate concentrations from the Lakefront Plant would be significantly less than observed at Keystone. The lower emission rate and greater dilution resulting from the multiple stacks would tend to reduce sulfate concentrations, probably by an order of magnitude. The only difference which would tend to increase sulfate concentrations is the fact that the plume will be at a lower level, thus reducing the potential for SO_2 desorption. However, the low solubility of SO_2 at the background pH levels encountered near Conneaut will reduce the effect of SO_2 absorption/desorption compared to the apparent desorption at Keystone. Below-plume rainfall sulfate concentrations observed at Keystone were approximately 1.0-1.5 mg/l above background. Thus, from this qualitative analysis, the expected rainfall sulfate concentrations are expected to be increased less than 0.2 mg/l by the Lakefront Plant plume.

4.498
Several formulae have been proposed to describe sulfate washout from plumes which may be compared with the above estimate which was based on observations. One formula proposed by Dana, et al. (4-20) is based on the assumption that rainfall sulfate comes solely from washout of sulfate, which has been oxidized from SO_2 prior to incorporation in the raindrops. Actually, the process involves SO_2 oxidation within the raindrops, but it is not possible to quantify the two phenomena separately based on their observations. Estimated rainfall sulfate concentrations for a "typical" storm assuming a rainfall rate of one mm/hr, a wind speed of eight m/sec, C stability,

and an emission rate of 370 gm/sec. have been calculated. The plant is assumed to be an area source, an assumption also used in the section on generation of sulfate aerosol. Under these conditions it is found that the maximum rainfall sulfate concentration occurs some 20 kilometers downwind and is 0.06 mg/l above the background. This is an insignificant change when compared with background sulfate concentrations of approximately four mg/l. A more severe impact occurs when a rainfall rate of 0.5 mm/hr, wind speed of five m/sec, D stability, and an emission rate of 470 gm/sec. This is postulated as a worst case, although the rainfall concentration goes up indefinitely as the precipitation rate is decreased. Under these conditions, the maximum sulfate concentrations would occur 20 kilometers downwind and would be 0.3 mg/l above background concentrations, an increase of less than 10 percent.

4.499
Another technique for estimating a washout of sulfate aerosol is the scavenging ratio, as defined by Gatz (4-21). Utilizing this formula, predicted maximum sulfate concentrations are 0.8 mg/l above background 20 km downwind for typical conditions and 3.3 mg/l above background 20 km downwind for worst case conditions. These estimates are significantly higher than those observed at Keystone and indicated by the formulae of Dana, et. al. (4-20), which have a much firmer observational basis. However, Dana's formula was based on observations from an elevated plume where low ground level SO_2 concentrations allowed SO_2 desorption, in contrast to the present application. These estimates based on scavenging ratio are presented as an alternative technique and may represent an upper bound on actual impacts at the proposed lakefront facility.

Deposition of Air Pollutants on Land and Water Surfaces

4.500
The dry deposition of SO_2 and NO_2 may be estimated by means of a deposition velocity, which is multiplied times ground level air concentrations to obtain a flux of the gas to the land or water surface. These gases are soluble in water and may be absorbed by vegetated surfaces, or moist soils. Many investigations have been made into the deposition velocity of SO_2 for various surfaces and it has been found to vary with the type of vegetation, the atmospheric stability, the pH of the surface (soil or water), and the wind speed. However, most investigations have indicated a deposition velocity near one cm/sec and it is assumed that this velocity is typical of both vegetated and water surfaces in the Regional Study Area. Deposition velocities for the oxides of nytrogen have not been determined accurately for water surfaces. However, the available data from vegetated surfaces indicate that the deposition velocity is roughly the same or less than that for SO_2. Since the deposition velocity

of gases to water is expected to depend on the solubility of the gas in water, the deposition velocity for NO and NO_2 is expected to be less than but nearly equal to that of SO_2 or 0.5 to one cm/sec.

4.501
Using these estimates it is possible to estimate the flux of these gases to the lake based on the estimated annual average concentrations of these gases over the lake as predicted by the CDM model. The simplification of the many meteorological variables affecting the dry deposition of gases into a constant deposition velocity multiplied by the annual average concentration is only the basis for a rough estimate of the contribution of the proposed plant to depostion of SO_2 and NO_2 to the lake. However, based on uncertainties about atmospheric removal and transport processes over water, it is not likely that a more detailed analysis would lead to better estimation of dry deposition rates. When compared with the total emission of the proposed Lakefront Plant, it is estimated that eight percent of the atmospheric emissions of SO_x and NO_x from the plant are deposited in Lake Erie. Wet deposition of SO_x and NO_x by rainfall is more difficult to estimate theoretically than dry deposition. However, it is known that the washout of SO_2 and NO_2 will be minimal at the low pH characteristic of rainfall in the Lake Erie basin. It is likely, from available evidence, that dry deposition will exceed the wet deposition. (4-22)

4.502
The deposition of atmospheric particulates is strongly dependent on the particle size as well as such meteorological variables as wind speed and stability. Since nearly all sources of particulates at the proposed plant will be covered and/or controlled by precipitators, baghouses, etc., the particles which are emitted will tend to be very small. The applicant estimates that the largest proportion of the particles will be less than a micron in diameter, while the mass will be dominated by the somewhat fewer particles ranging from one to five microns in diameter. If the mass median diameter is estimated as two microns, then the predicted (4-39) dry deposition velocity is of the order of 0.1 cm/sec. Applying this deposition velocity with the CDM predictions for suspended particulate over the lake yields a deposition rate of 34 metric tons per year. Thus, about one percent of the plant emissions would be deposited in the lake annually. The particulates emitted from the plant will consist mostly of fly ash, soot and iron oxides, which contain trace quantities of the heavy metals usually found in coal and iron ore. There is very little evidence to indicate whether these trace metals will be associated preferentially with small or large particles so the deposition rate may follow that indicated for the total suspended particulate roughly in proportion to the elemental concentrations in the emissions. However, it is not possible to estimate the deposition rates for the various metals

until reliable estimates of these emissions are obtained. Wet deposition of particulates in the Great Lakes is often found to be approximately equal to the dry deposition. (4-23, 24) The relative importance of each is determined by the frequency of rainfall events, the size and vertical distribution of the particulate material, the stability of the atmosphere, etc., such that wet deposition predominates for smaller particles and dry deposition for larger particles (refer to Table 4-278).

Cooling Tower Impacts

4.503
Forced draft wet cooling towers will be employed to cool the recirculating water. The cooling towers will be located near the processes where the heat is generated and consequently will be distributed around the plant site at eight different locations. This distribution around the plant, as opposed to a single concentration of cooling towers, should diminish adverse environmental effects. The most severe environmental effects associated with forced draft cooling towers include: (1) ground level fogging during windy humid conditions, (2) icing of roads, equipment or foliage during windy winter weather, (3) noise generation associated with the fans. (4-25) Observations of noise at a similar steel plant using forced draft cooling towers indicate that the impact of the cooling tower noise, relative to other plant generated noise, is small and will not pose a significant environmental problem. Ground level fogging and icing will be limited to a small area around the towers. Since these units are distributed throughout the facility (i.e., not concentrated in one area) and are located well within the site boundary fogging or icing in the area surrounding the proposed plant site will not occur.

4.504
The release of water vapor from the cooling tower and the availability of latent heat over a limited area may affect the development and propagation of meso and smaller scale precipitation phenomena. Precipitation enhancement and the triggering of convective showers within a few miles of the facility are potential effects due to the increases in energy flux. However, this precipitation enhancement will be reduced by the forced draft operating mode of the cooling towers. Natural draft cooling towers will result in higher moisture concentration than the mechanically driven tower. Therefore, triggering of convective showers would not normally occur. Salts and other dissolved or suspended materials in cooling tower waters may be entrained in droplets of vapor (drift) emitted by the towers and deposited downwind. Additives such as scale and corrosion inhibitors and biocides may also be entrained and subsequently deposited downwind. If these additives are volatile they may be transmitted directly to the atmosphere. The applicant has not estimated the

Table 4- 273

Deposition of Atmospheric Emissions in Lake Erie

Parameter	Dry Deposition rate (Metric Tons per Year)[1]	Dry Deposition Rate as: % of total Lake Erie Input by Precipitation[2]	Dry Deposition Rate as: % of total Plant Air Emissions[1]
NO_X as N	410 [3]	2%	8%
SO_X as S	490 [3]	1%	8%
Suspended Particulates	34 [4]	--	1%

(1) Arthur D. Little, Inc. estimates.

(2) Direct input to Lake Erie of NO_3 and SO_4 by precipitation has been determined by K.W. Kuntz of the Department of Fisheries and the Environment, Canada, and reported at the 20th Conference on Great Lakes Research, Ann Arbor, Michigan, 1977.

(3) Wet deposition rates are expected to be significantly less than the dry deposition rates.

(4) Wet deposition rate nearly equal to dry deposition rate.

quality or effect of the release of these materials to the atmosphere.

Impacts of Abnormal Events

4.505
Abnormal events causing impacts on the atmospheric regime would arise from malfunctions of plant facilities or emission control systems during plant operations. The plant process facilities and the sources of emissions have been examined for malfunction by the applicant. This effort resulted in examination of the 106 emission sources of the proposed Lakefront Plant that are listed in the Plant Emission Inventory section of Chapter One. These could be grouped into five categories of no additional emissions and a sixth category of incremental emissions due to malfunction. Those operations which do not contribute additional emissions because one or more of the following procedures are incorporated within the process or emission control practice are shown below:

- No pollution control is required.
- Sufficient storage is provided to permit shutdown of process unit (with the malfunction) for the time required to correct the failure.
- The process is interlocked, so that it cannot be operated during the failure of the pollution control equipment.
- Sufficient redundancy is provided in the pollution control device so that there is always sufficient equipment to maintain normal control.
- The process can be by-passed during pollution control failure.

4.506
The sixth category of process step malfunction causing incremental emissions consisted of raw and processed materials transfer points; lime handling, coal preheating and handling, coke pushing, sinter plant exhaust, blast furnace slips, and scarfing emissions. Except for blast furnace slips, the malfunctions of these process steps are attributable to the emission control equipment. Blast furnace slips occur as an irregularity of process conditions.

4.507
The category of malfunctions with incremental emissions amounts to 19 process units, (refer to Table 4-279) of which six occur as individual operations and others occur as dual units. If all the malfunctions were to happen within the same 24-hour day, the total

Table 4- 279

Maximum HIWAY CO Concentrations (mg/m^3)

Intersection	Option	Year	Receptor Coordinates (m)	Maximum 8-Hr. Avg. (mg/m^3)	Receptor Rush Hr.	Maximum Rush Hr. (mg/m^3)
I-90/SR-7	Baseline	1981	50,25,0	1.0		
		1985	50,25,0	.9		
		1990	50,25,0	.8		
I-90/US-6N	Baseline	1981	50,25,0	1.0		
		1985	50,25,0	.9		
		1990	50,25,0	.8		
I-90/SR-7	Preferred (4)	1981	25,25,0	1.0	25,25,0	2.7
		1985	50,25,0	.9	25,25,0	1.3
		1990	50,25,0	.9	25,25,0	.7
I-90/US-6N	Preferred (4)	1981	50,25,0	1.0	25,25,0	1.6
		1985	50,25,0	.9	25,25,0	1.0
		1990	50,25,0	.8	50,25,0	.7
US20/State-line Rd.	No-Build	1981	100, -18	.7	100, -18	2.3
		1985	100, -18	.5	100, -18	1.1
		1990	100, -18	.4	100, -18	.6
Cloverleaf	Preferred (4)	1981	100, -18	.4	100, -18	.5
		1985	100, -18	.3	100, -18	.4
		1990	100, -18	.3	100, -18	.3
Third Rotary (additional I-90 interchange with direct access to plant)	Preferred (4)	1981	50,25,0	1.2	25,25,0	2.7
		1985	50,25,0	1.0	25,25,0	1.3
		1990	50,25,0	.9	50,25,0	.7

incremental emissions would amount to about 2,500 pounds. This would be equivalent to a short-term average emission rate of 13.0 gm/sec. Modeling of the particulate emission rate from the affected sources have shown that under the worst day meteoroloical conditions, the incremental impact on air quality is about three ug/m (24-hour average). This incremental impact in addition to normal operations does not cause the allowable emissions limitation for prevention of significant deterioration to be exceeded. A detailed analysis of the comparitive probabilities of various combinations of malfunctions and their respective incremental emission of particulates from the proposed plant is on file with the U. S. Corps of Engineers, Buffalo District. The probability analysis has examined several levels of emissions and groups of malfunctions in conjunction with typical and worst case meteorological conditions. This analysis takes into account the regulatory requirement that the standards are not to be exceeded more than once per year. The results show that an incremental emission level of 161 kilograms has a probability of .0005 for occurring more than once per year and in conjunction with worst case meteorology only about 0.00005.

Secondary Impacts

Methodology

4.508
Two computer programs were used to predict secondary impacts on air quality, Modified Climatological Dispersion Model (MCDM), and HIWAY. The former can be employed to generate a series of pollutant concentration vs. distant plots (isopleths) taking into account contributions from point and area emission sources. The latter is utilized primarily in the assessment of potential "hot spots" near highways, i.e., locations where a possibility of the violation of ambient air quality standards might occur. Each model will be discussed separately in the following sections.

a) Long-Term Particulate and Sulfur Dioxide Impacts (MCDM)

4.509
Based on the 1985 and 1990 results, the region surrounding the plant will not exceed the particulate and sulfur dioxide annual standards. The high levels in downtown Erie are not affected by the plant or secondary growth and will remain unchanged unless emissions in the city are reduced.

4.510
The largest contributions to emissions in the areas of interest occur in Ashtabula and Erie Counties. Therefore, these counties were the principal ones entered into the model. For area emissions, it was

necessary to divide the county-wide data into sub-areas to provide an adequate representation of the true situation. For this purpose, an emission grid was constructed and emissions were assigned to each block, based on relative population density for that area of a county. The area source emission grid input to the model for both baseline and impacts is shown in Figure 4-60. To produce isopleth plots for the 11-region area, a receptor grid of two-kilometer intervals was set up (refer to Figures 4-61 and 4-62).

4.511
A background concentration of 32 ug/m^3 added to the particulate run which is based on results of particulate studies throughout the country. The isopleths shown in Figure 4-61 indicate that the two areas with levels well above background are in the cities of Ashtabula and Erie with a slightly higher than background value in Conneaut. The plot agrees well with the observed monitor data for the region for 1976 and represents base conditions for the area. The sulfur dioxide plot shown in Figure 4-62 shows a similar trend. To project the future impact of the plant, additional information was provided by the SIMPACT IV Model. The data provide were used to estimate growth trends, which, in this case, would be in the area emissions produced by fuel combustion (based on the increase in population during the plant construction and operation). The sources of combustion under consideration are fuel oil, natural gas, and highway vehicles. By estimating the fuel consumption or vehicle usage at a future date, emission rates were also developed. (For each type of source, an emission factor was determined from EPA document AP-42, based on emissions per unit activity.)

4.512
The final output from SIMPACT appears in the form of annual emissions (for sulfur oxides and particulates), for the years 1985 and 1990, broken down into the eleven regions described previously. These values were further subdivided proportionately by area among the squares of the MCDM emission grid. The MCDM was used to construct two isopleth plots for baseline plus secondary growth for the years 1985 and 1990, which are shown in Figures 4-63 through 4-66. The figures show the increased particulate and sulfur dioxide concentration due to the plant with only a slight increase from the population growth for the area. In both the 1985 and 1990 runs a reduction of 90 percent of particulate emissions from the Ashtabula power plant was included. This results in a reduction of emissions for the region of approximately 16,000 to 17,600 tons per year, an amount that still outweighs both the increased emissions from the proposed Lakefront Plant and the increased population. The impact of this reduction on annual average concentrations is small (1 to 5 ug/m^3 because the emissions are from tall stacks with hot buoyant plumes. However, the impacts of the reductions on short-term

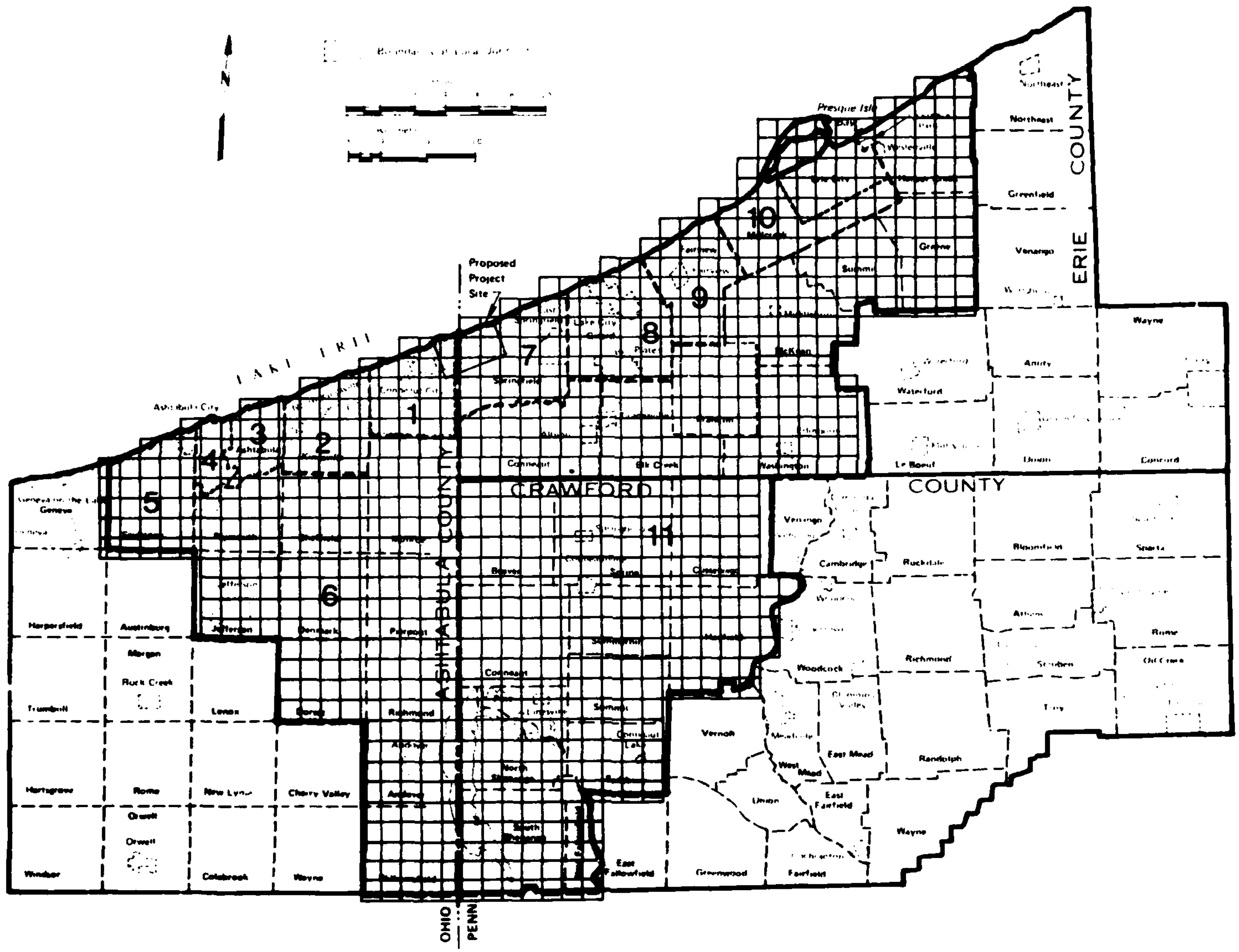
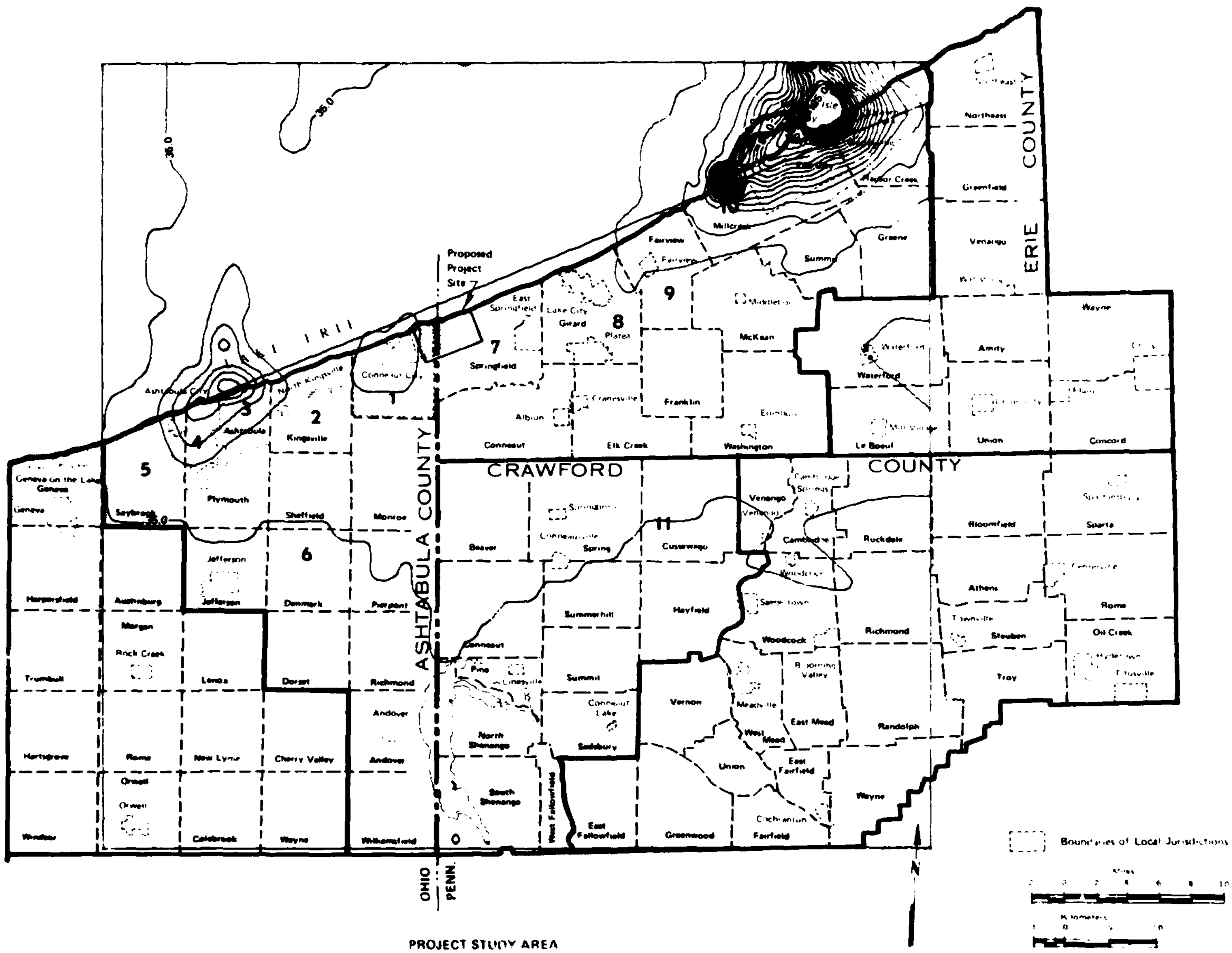


FIGURE 4—60 AREA SOURCE EMISSION GRID (INPUT TO MCDM), TWO KILOMETER GRID DIVISION



PROJECT STUDY AREA

FIGURE 4–61 ISOPLETHS OF PARTICULATE LEVELS IN THE REGIONAL STUDY AREA – BASELINE ($\mu g/m^3$)

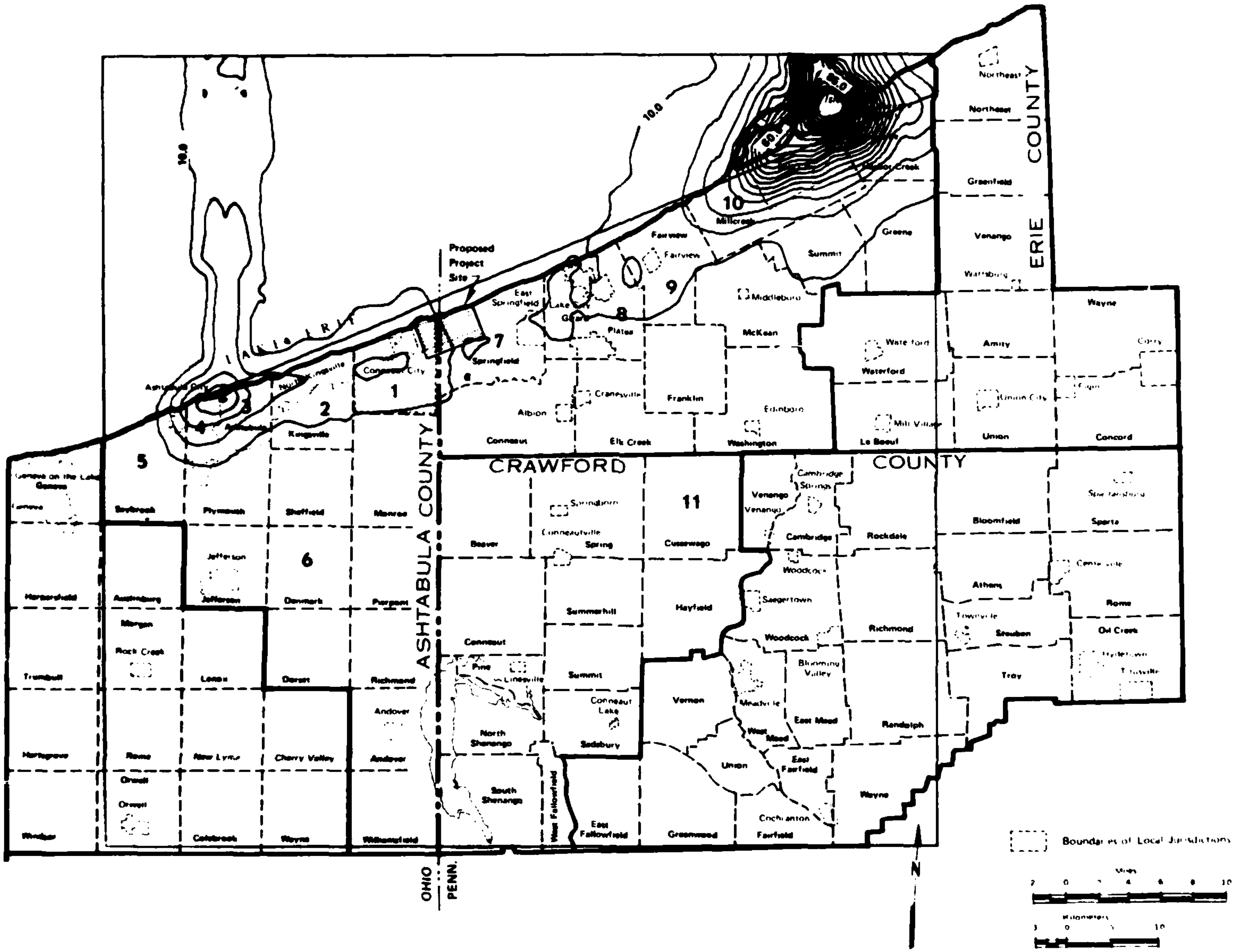


FIGURE 4–62 ISOPLETHS OF SO_2 LEVELS IN THE REGIONAL STUDY AREA – BASELINE ($\mu g/m^3$)

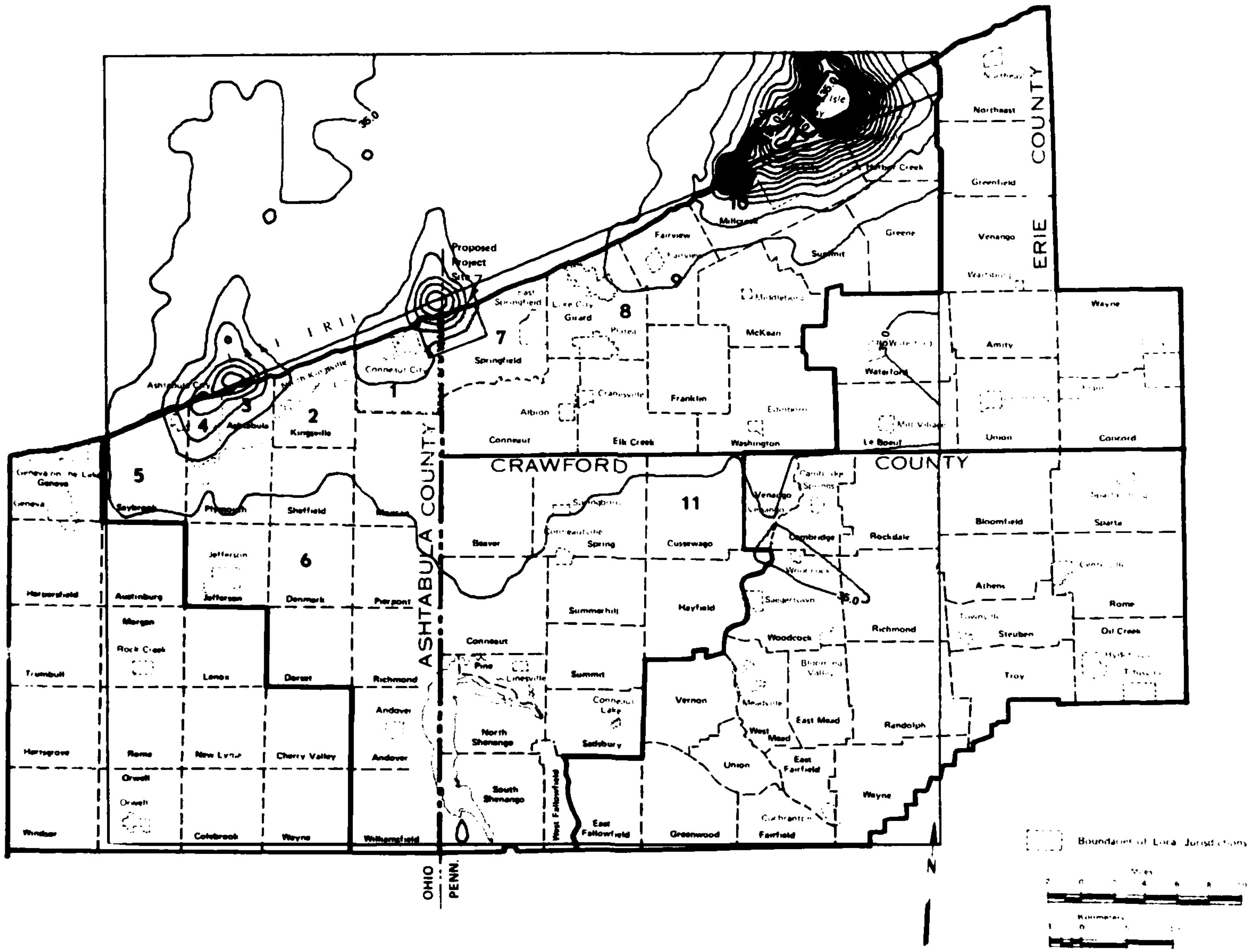


FIGURE 4–63 PROJECTED PARTICULATE LEVELS IN THE REGIONAL STUDY AREA – 1985 ($\mu g/m^3$)

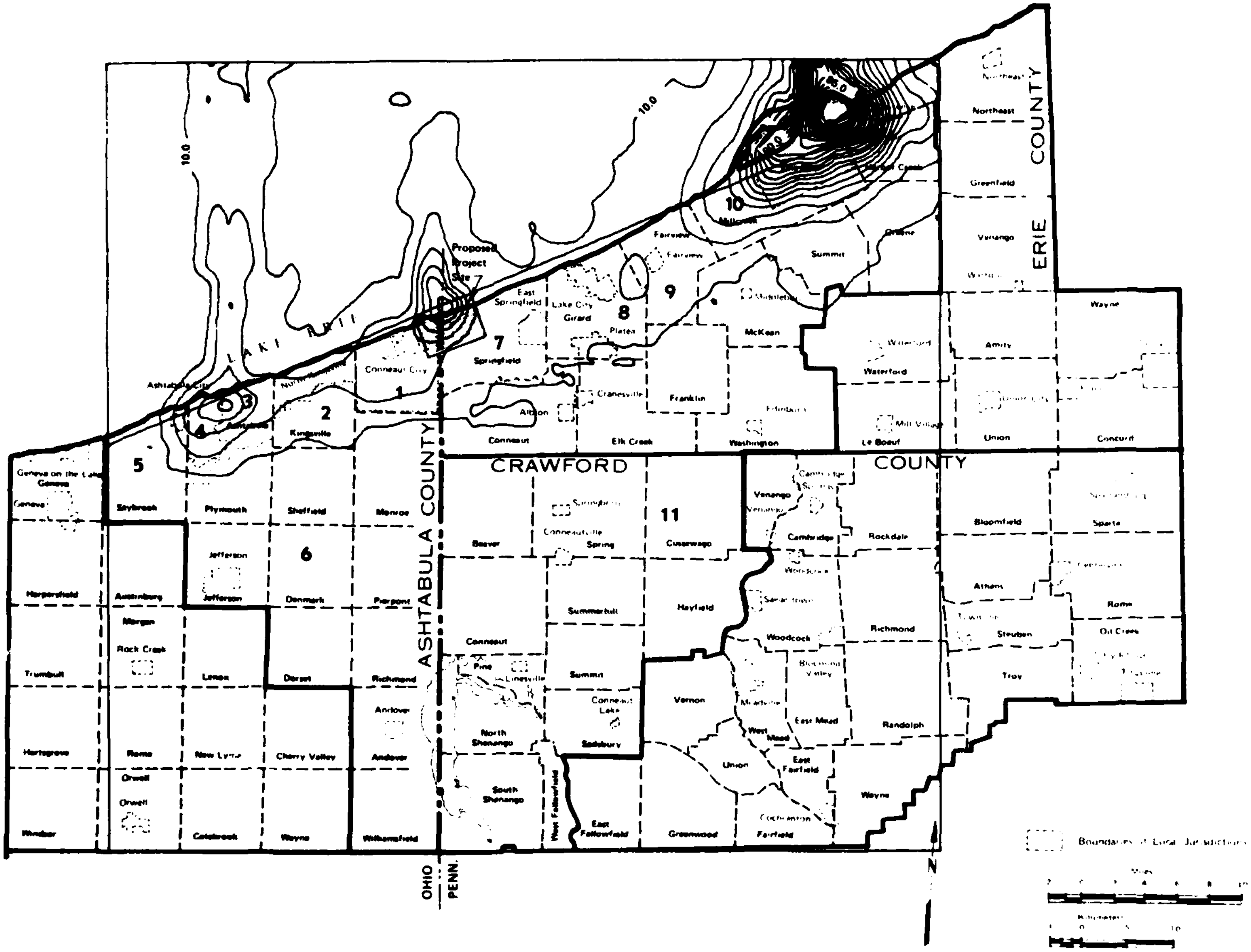


FIGURE 4–64 PROJECTED SO_2 LEVELS IN THE REGIONAL STUDY AREA – 1985 ($\mu g/m^3$)

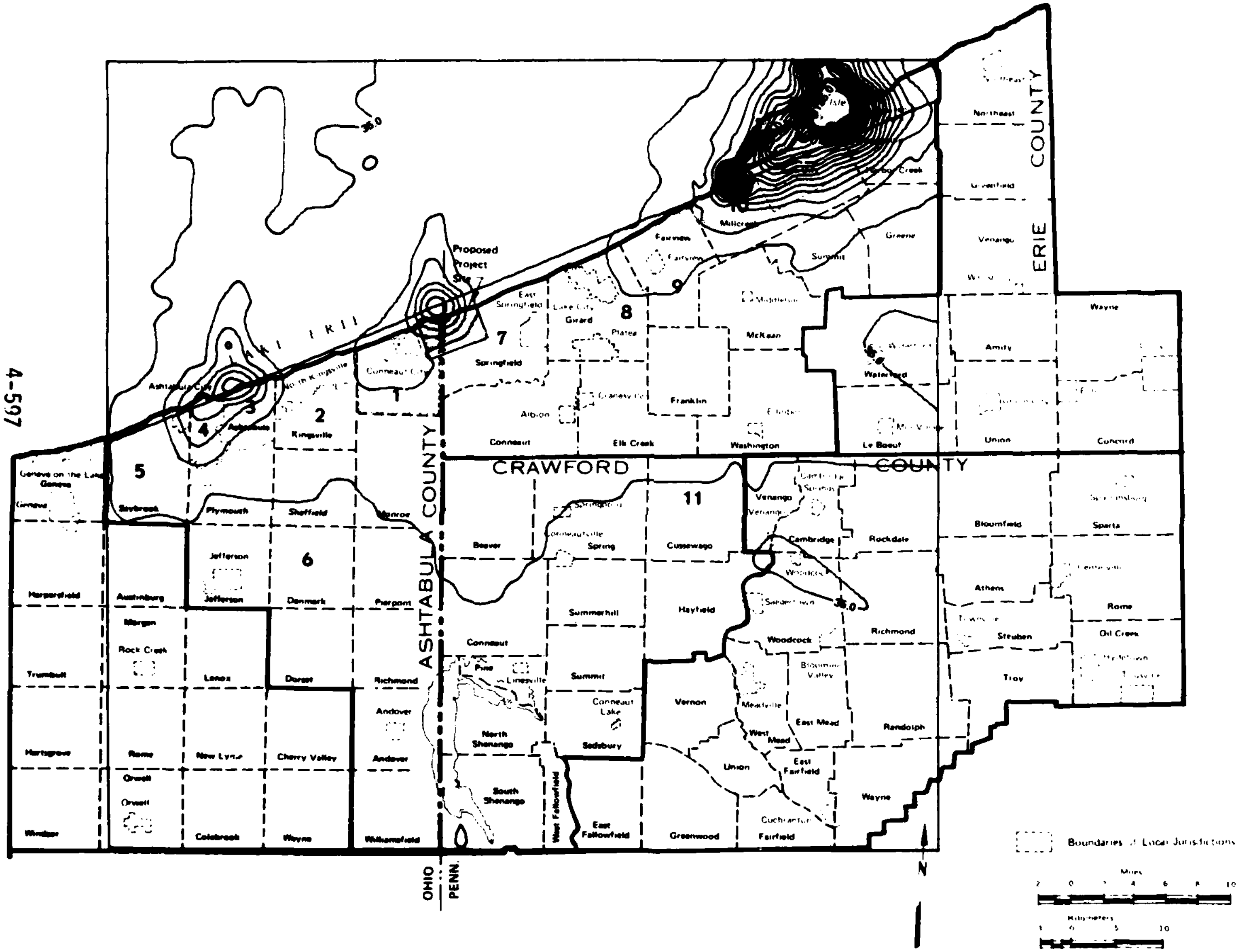


FIGURE 4–65 PROJECTED PARTICULATE LEVELS IN THE REGIONAL STUDY AREA – 1990 ($\mu g/m^3$)

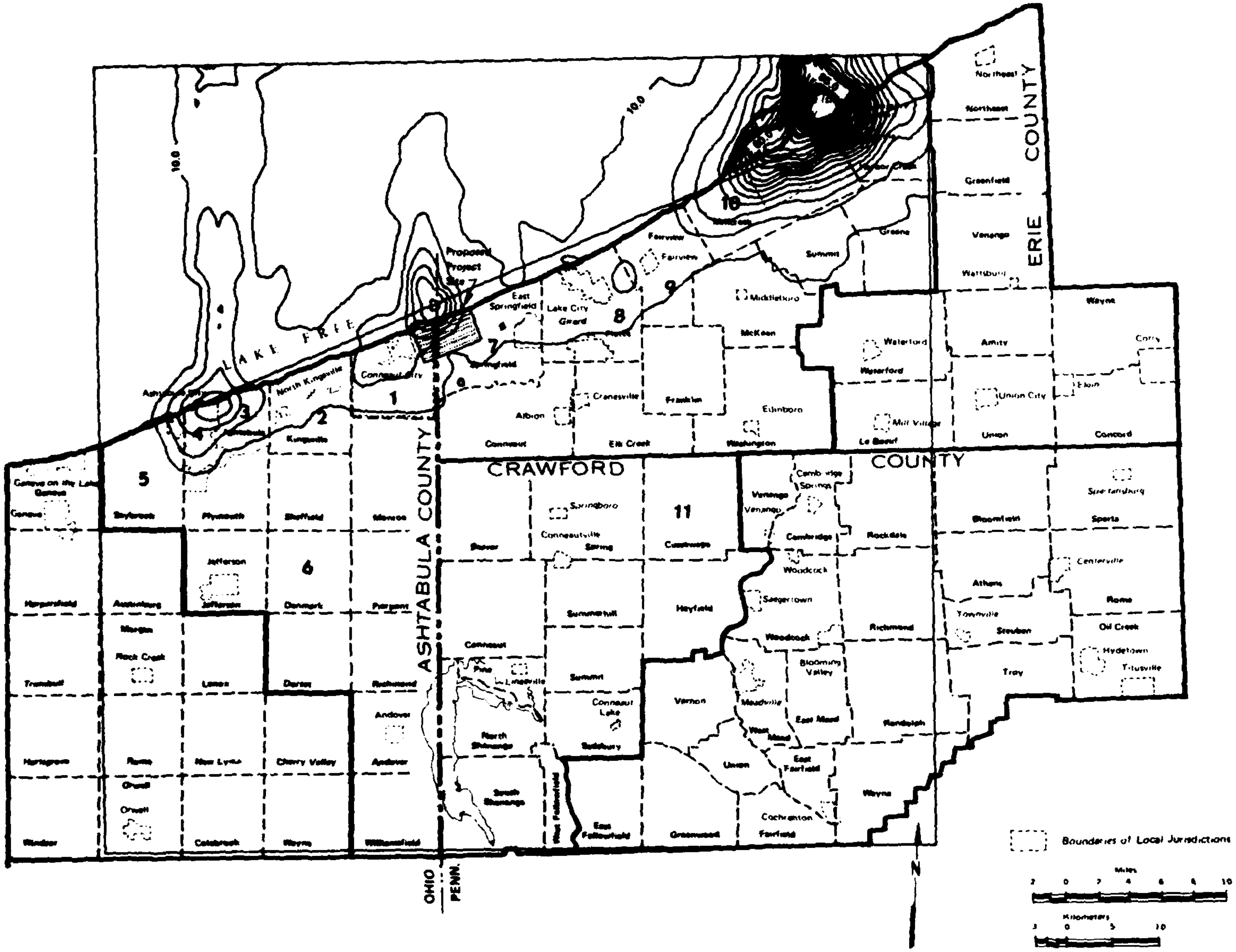


FIGURE 4—66 PROJECTED SO_2 LEVELS IN THE REGIONAL STUDY AREA – 1990 ($\mu g/m^3$)

concentrations for the region could be significant and could outweigh the increases from the steel plant.

b) Short-Term Carbon Monoxide Impacts from Secondary Traffic - HIWA

4.513
The data produced by this model describe the air quality in the immediate area of a highway. In particular, the model was designed to calculate the carbon monoxide concentrations around a locale suspected of violating ambient standards. The calculation of emissions is based on the number of types of vehicles passing per unit of time, as determined by actual traffic counts. From emission factors (dependent on vehicle speeds) determined using "AP-42, Supplement No. 5 for Compilation of Air Pollutant Emission Factors," and the information on traffic, emission rates for specific locations are found. The output from HIWAY is in the form of pollutant concentrations at specified receptors. The locations are selected to provide a worst case for possible exposure to carbon monoxide. In actuality, a series of receptors is modeled to provide an indication of the change in concentration with distance from the source. For the purpose of identifying potential air quality violations, emissions over one-hour periods were determined. Two cases were investigated in this manner: (1) one-hour maximum traffic flow (assumed to occur between 7:00 a.m. and 8:00 a.m., for the plant), and (2) eight consecutive one-hour periods, with varying meteorological conditions, beginning at 7:00 a.m.. (The eight hourly traffic flows were based on cumulative eight-hour traffic counts divided by eight.)

4.514
Hourly meteorological data from Erie were computer-searched for eight-hour periods having high persistence, low wind speeds, and winds roughly parallel to the major east-west routes, 20 and 90. All eight-hour periods having a persistence of greater than 0.98 were ordered according to mean wind speed, with the lowest wind speeds given first consideration. The final criterion for selection was that the wind direction be roughly east-west slightly oblique to the direction of the major thoroughfares. On this basis, 8 August 1976, hours 8:00 a.m. to 4:00 p.m., was selected as the eight-hour period exhibiting highest potential for high ground level carbon monoxide concentrations near these highways. The hourly wind data are presented in Table 4-280. The eight-hour persistence during this period was 0.99. The mean wind speed was 2.9 meters per second and the wind direction was westerly.

4.515
In the first case to be modeled, a baseline situation was assumed, in which there was no plant traffic -- only a future projection of the

Table 4-280

Meteorology Used in HIWAY Model - 8 August 1976

Hour	Wind (Degrees) Direction	Wind (m/sec) Speed	Stability Class
8[1]	270	2.7	4
9	290	3.1	4
10	280	2.2	4
11	280	3.6	3
12	270	2.2	3
13	270	2.7	3
14	270	4.0	4
15	270	2.7	4
16	270	2.7	4

[1]Represents rush hour; this meteorology was used in the one-hour model.

Source: Erie Airport Data.

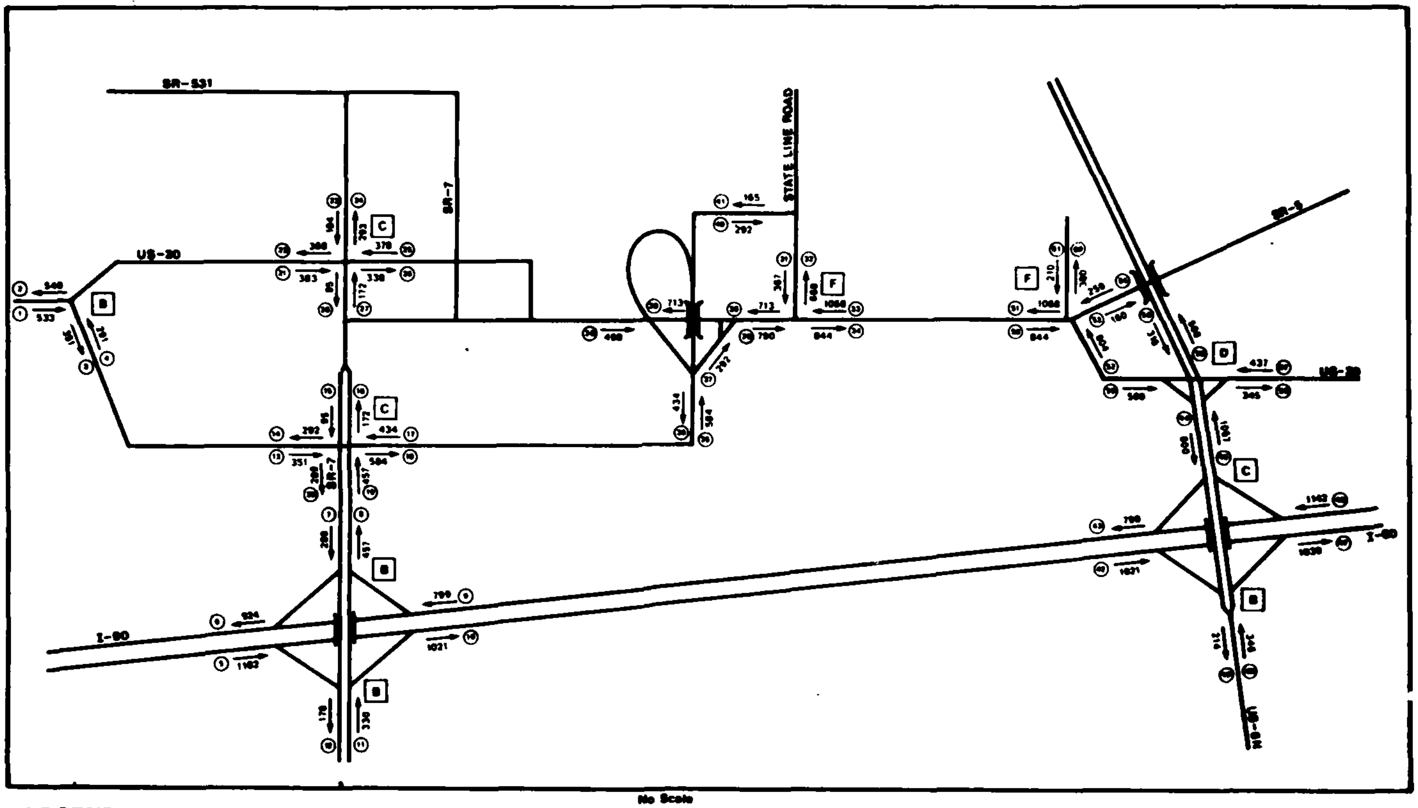
current traffic flows. Based on a study of the traffic patterns and the likelihood that additional vehicles could violate air quality standards, two highway locations near Conneaut were selected for modeling. These were the intersections of (1) I-90 and SR 7, and (2) I-90 and U. S. 6N. One should note that the traffic counts for baseline are not necessarily a maximum during the 7:00 to 8:00 a.m. period selected for study.

4.516
The second case which was modeled was a "no-build" situation in which the plant was built and plant traffic added to baseline, but no additional highway was constructed. Results were computed for one-hour and eight-hour data for the two intersections described above. A third condition considered was an additional I-90 interchange with direct access to the plant.

4.517
Finally, the fourth case involved building the plant, and additionally a U. S. 20 bypass near State Line Road. This case was analyzed as it appears to be the worst case air quality situation. Traffic flows at the proposed cloverleaf, as well as altered traffic patterns for the two other intersections were computed for the one-hour and eight-hour data. Traffic patterns for the proposed cloverleaf for direct access to I-90 were also considered.

4.518
To place the HIWAY modeling effort in perspective, the information produced -- in terms of carbon monoxide concentrations at receptors near highways -- can be compared for four cases. These are: (1) baseline, (1) "no-build" with plant traffic added to baseline, (3) an additional I-90 interchange with direct access to the plant, and (4) "Route 20 bypass" with highway construction, and plant traffic added to baseline. The presence or absence of areas which would not meet air standards can, therefore, be determined, as well as any significant deterioration in air quality from the baseline. The alternative traffic flow patterns are given in Figures 4-67 and 4-68. A more detailed description is given in the Transportation section of Chapter Six.

4.519
The results of the HIWAY modeling for the major intersections are summarized in Table 4-281. In all cases the carbon monoxide levels are extremely low with maximum concentrations less than 3 mg/m^3 including baseline traffic. The principal reason for the small change is due to the planned decrease in emissions levels for automobiles in the future. The reduced CO emissions for future automobile baseline traffic would far outweigh the increased emissions from transportation related to secondary growth from the proposed plant.



LEGEND:

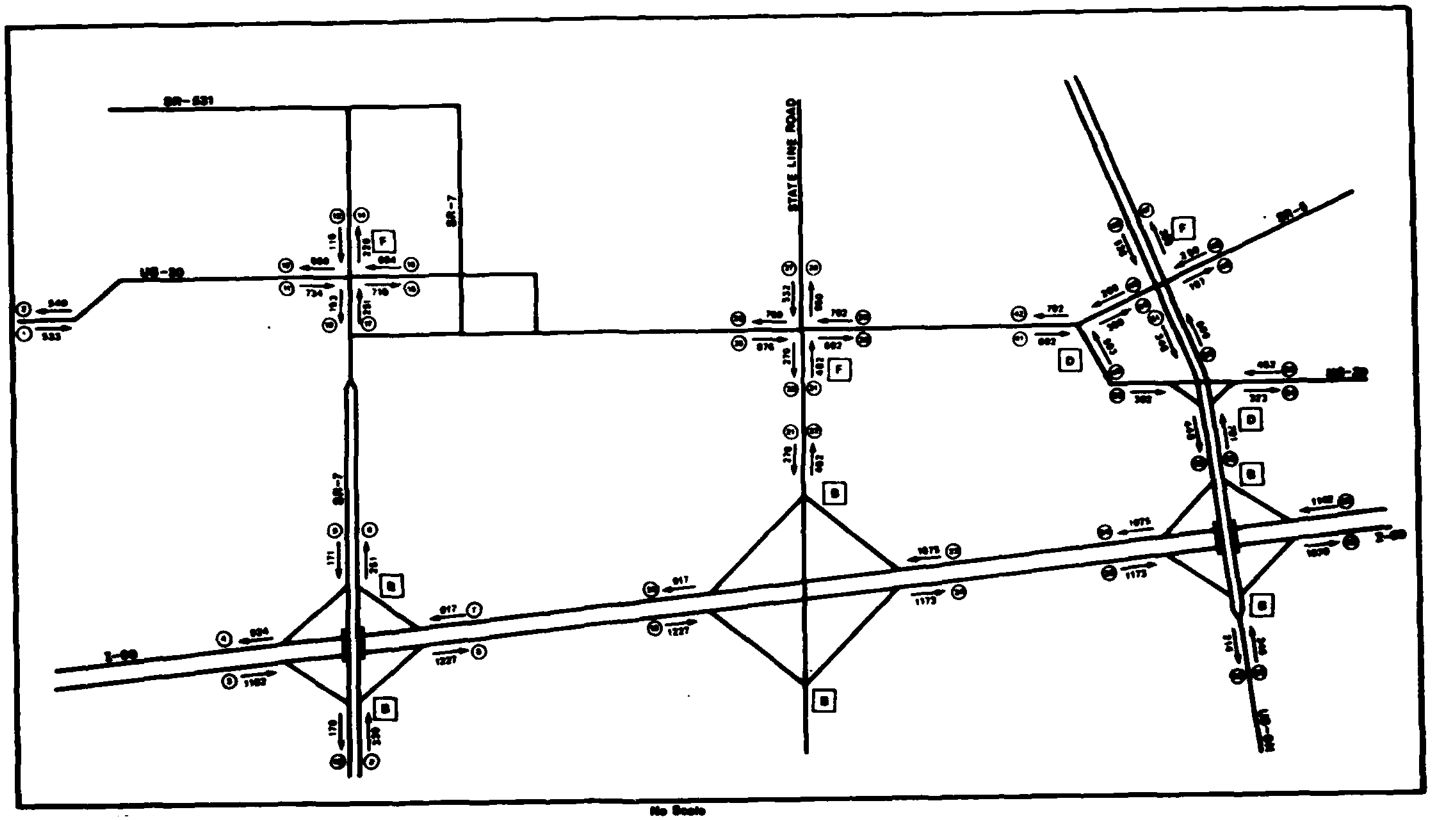
876 → Number of Vehicles

(6) Appendix Table Location Reference Number

New Roadways

F Level of Service

FIGURE 4–67 PROJECTED LAKEFRONT PLANT-RELATED TRAFFIC FLOW IN THE IMMEDIATE PLANT AREA – 1990



LEGEND:

876 → Number of Vehicles

(6) Appendix Table Location Reference Number

New Roadways

[F] Level of Service

FIGURE 4–68 PROJECTED TRAFFIC FLOWS IN IMMEDIATE LAKEFRONT PLANT AREA, 7 TO 8 AM – 1990 (ROUTE I–90 DIRECT ACCESS)

Table 4-281

Maximum HIWAY CO Concentrations (mg/m^3)*

Intersection	Option	Year	Receptor Coordinates (m)	Maximum 8-Hour Avg. (mg/m^3)	Receptor Rush Hr.	Maximum Rush Hr. (mg/m^3)
I-90/SR-7	Baseline	1981	50,25,0	1.0		
		1985	50,25,0	.9		
		1990	50,25,0	.8		
I-90/US-6N	Baseline	1981	50,25,0	1.0		
		1985	50,25,0	.9		
		1990	50,25,0	.8		
I-90/SR-7	Preferred (4)	1981	25,25,0	1.0	25,25,0	2.7
		1985	50,25,0	.9	25,25,0	1.3
		1990	50,25,0	.9	25,25,0	.7
I-90/US-6N	Preferred (4)	1981	50,25,0	1.0	25,25,0	1.6
		1985	50,25,0	.9	25,25,0	1.0
		1990	50,25,0	.8	50,25,0	.7
US20/State-line Rd.	No-Build	1981	100, -18	.7	100, -18	2.3
		1985	100, -18	.5	100, -18	1.1
		1990	100, -18	.4	100, -18	.6
Cloverleaf	Preferred (4)	1981	100, -18	.4	100, -18	.5
		1985	100, -18	.3	100, -18	.4
		1990	100, -18	.3	100, -18	.3
Third Rotary (additional I-90 interchange with direct access to plant)	Preferred (4)	1981	50,25,0	1.2	25,25,0	2.7
		1985	50,25,0	1.0	25,25,0	1.3
		1990	50,25,0	.9	50,25,0	.7

* Concentrations include emissions from baseline traffic not related to the proposed lakefront plant. The ambient concentrations in this table, therefore, include major portions of the background.

Since the baseline levels in the region are now well below the one-hour and eight-hour average standards, (see the Air Quality baseline section of Chapter Two), no CO problem for the area would be expected to occur as a result of secondary growth.

4.520
Figures 4-63 through 4-66 show the increased particulate and sulfur dioxide concentration due to the plant with only a slight increase from the population growth for the area. In both the 1985 and 1990 modeling calculation, a reduction of 90 percent of particulate emissions from the Ashtabula power plant was included. This results in a reduction of emissions for the region of approximately 16,000 to 17,600 tons per year, an amount that far outweighs the increased emissions from the proposed Lakefront Plant and the increased population. The impact of this reduction on annual average concentrations is small (1 to 5 ug/m^3) because the emissions are from tall stacks with hot buoyant plumes. However, the impacts on short-term concentrations for the region could be significant and could outweigh the increases from the proposed Lakefront Plant.

Combined Impact of the Proposed Steelmaking Facility and Proposed Coho Generating Station on PSD Class II Increments

4.521
In response to comments on the draft EIS the impact of the proposed U. S. Steel facility on air quality was analyzed in light of the proposed construction of the Coho Steam Electric Generating Station. The Coho Station, as proposed by Generel Public Utilities Corporation (GPU), is to be located at Lake City, PA, approximately 13 kilometers east-northeast of the proposed steelmaking facility. The coho station will be coal-fired with a projected capacity of 690 mw gross, 625 mw net. The present construction schedule leads to commercial operation by May 1988. The USEPA, Region III Office, is currently analyzing data on the coho plant with the intention of preparing an Environmental Impact Statement. A meeting was held at the USEPA, Region III Office, on 8 September 1978 to discuss the principal air quality concerns as a result of operation of both proposed facilities. This meeting resulted in identification of SO_2 as the pollutant of primary concern when considering combined impacts. An analysis of the impact of these two facilities on the allowable prevention of Significant Air Quality Deterioration (PSD) SO_2 Class II increments is presented below.

4.522
The impacts of sulfur dioxide from the proposed U. S. Steel facility alone are indicated earlier in this chapter. The maximum PSD increments from the plant for annual, 24-hour and three-hour average

ambient concentrations are presented in those sections. All increments determined from CDM and RAM modeling were less than the allowed values. Additionally Penelec of the GPU Corporation has carried out a preliminary PSD review for the proposed Coho Station. In response to comments on the draft EIS for the proposed steelmaking facility, a modeling analysis has been performed to determine the combined effect of the two plants on the allowed PSD increments for sulfur dioxide as well as to determine their impacts with respect to ambient air standards.

4.523
Presently, no other PSD applications for the region have been made. Consequently the increments from these two facilities only can be considered in the PSD modeling analysis. The methodology used for the analysis of combined effects is the same as that used for the steel facility alone. The annual average impacts of the two proposed facilities were determined by using the model CDM, and the 24-hour and three-hour average impacts were determined by using the program RAM.

4.524
The ambient air monitor data for 1976 from Ashtabula County, OH and Erie County, PA, were available from the Ohio EPA and the Pennsylvania DER for the analysis. Data from seven monitors in Ashtabula County and six in Erie County are summarized in Tables 4-282 and 4-283. Additionally, recently completed results from two continuous SO_2 monitor stations operated at the proposed U. S. Steel site by Environmental Research and Technology (ERT) were utilized. Figure 4-69 shows the monitor locations in the region and T5P locations of the two proposed plants.

4.525
Only three of the State stations collected data on sulfur dioxide. These data are supplemented by the two U. S. Steel plant site monitors. The State data indicate that the ambient SO_2 levels are below the standards. The more comprehensive data from the two continuous SO_2 monitors at the U. S. Steel site again indicate that in 1977-78 the SO_2 levels at the Lakefront Plant site are well below the standards. The cumulative frequency plots indicate that the maximum one-hour average concentrations of 0.15 ppm at either monitor were significantly lower than the three-hour average standard of 0.5 ppm. At all the monitor stations the annual average SO_2 concentrations ranged between 29 and 45 micrograms per cubic meter or less than half the standard of 80 micrograms per cubic meter. The EIS previously indicated that for the first five months at the Conneaut monitors (sites 15 and 16) the maximum 24-hour average SO_2 concentrations were 100 and 120 micrograms per cubic meter or less than one-third the standard of 365 micrograms per cubic meter.

Table 4- 282 - Air Quality Data for Ashtabula County, 1976

Station Number	Particulates (ug/m^3)		SO_2 (ug/m^3)		NO_2 (ug/m^3)	Ozone (ppm)
	Max-24 hr.	Geom. Mean	Max-24 hr.	Arith. Mean	Arith. Mean	Max-1 hr.
(1)	244	73	152	34	46.25	-
(2)	143	60	-	-	-	-
(3)	129	54	-	-	-	-
(4)	159	65	1087 (1 hour)	45	-	-
(5)	122	40	-	-	-	-
(6)*	135	53	-	-	-	0.066
(7)*	140	41	-	-	-	-

*Located in Conneaut.

Source: Ohio Environmental Protection Agency

Table 4- 283 · Air Quality Data for Erie County, 1976

Station Number	Particulates (ug/m^3)		SO_2 (ug/m^3)		NO_2 (ug/m^3)	Ozone (ppm)
	Max-24 hr.	Geom. Mean	Max-24 hr.	Arith. Mean	Arith. Mean	Max-1 hr.
(8)	-	-	-	-	52.0	0.139
(9)*	181	40	-	-	-	-
(10)	446	70	-	-	-	-
(11)	187	64	-	-	-	-
(12)	674	112	-	-	-	-
(13)	179	38	-	-	-	-
(14)	-	-	184	29	-	-

*Station in Pennsylvania that is closest to the site (18 miles east) where secondary standard has been exceeded.

Source: Pennsylvania Department of Environmental Resources.

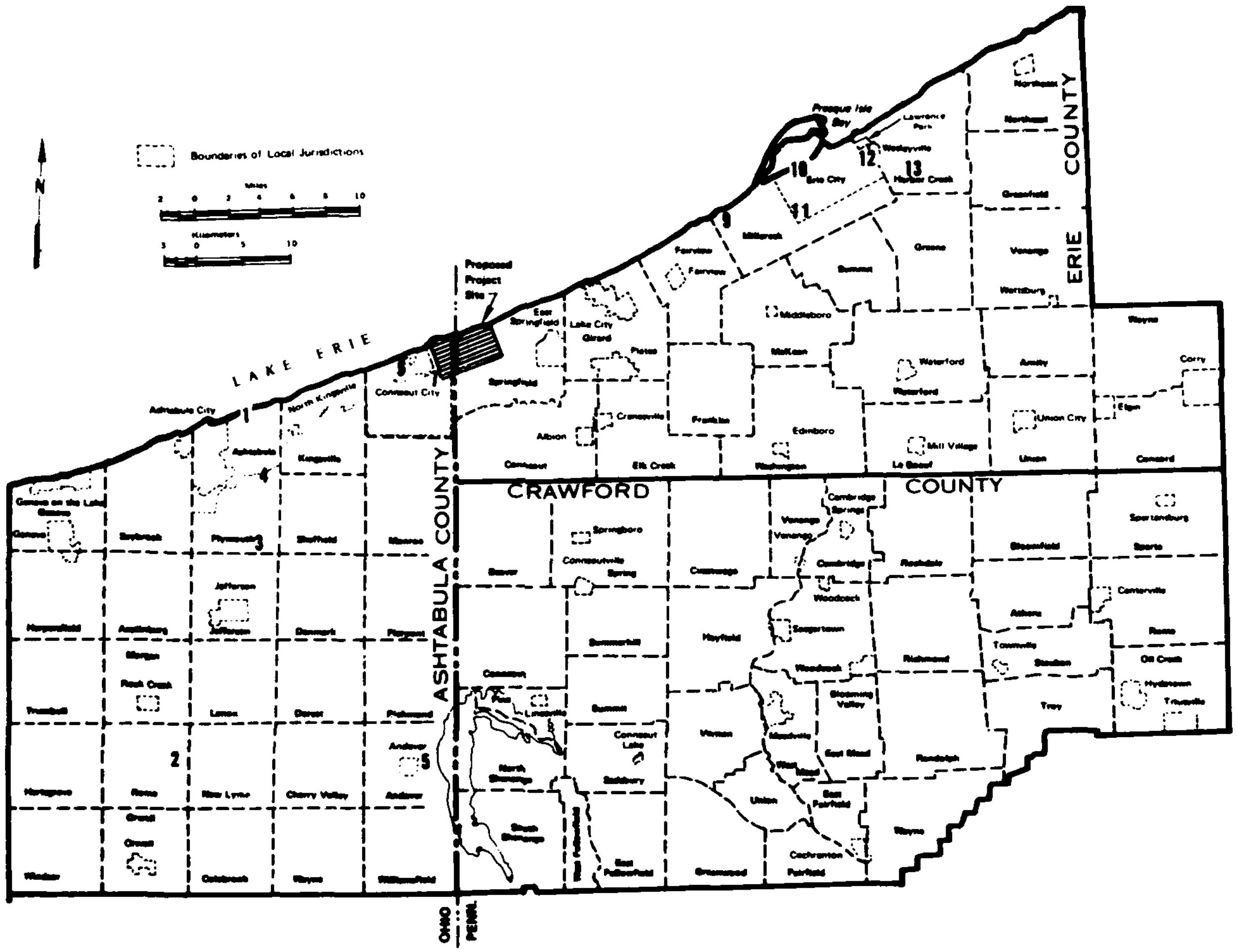


FIGURE 4-60 LOCATIONS OF AIR QUALITY MONITOR STATIONS IN THE REGIONAL STUDY AREA

Therefore, the maximum Class II PSD increments of 20, 91, and 512 micrograms per cubic meter for annual 24-hour and three-hour averages, would not cause the ambient air standards to be violated.

Annual Average SO_2 Concentrations

4.526
The impact of both facilities on the annual average sulfur dioxide concentrations were determined by modeling the emissions inventories as given in Tables 4-284 and 4-285. For determining impacts during operations, five individual years of meteorological data (1972-76) obtained at Erie Airport were used in the program CDM.

4.527
An expanded receptor grid was utilized in the calculations. This grid, as given in Figure 4-70, includes a series of receptors surrounding each facility as well as an increased number located in the area between the facilities. Preliminary investigations indicate that the maximum combined increments would occur within an area slightly west of the proposed U. S. Steel Plant along the Lake Erie shore to extend to an area slightly east of the Coho Generating Station. The maximum plume overlap would occur in this region.

4.528
Examination of the CDM runs indicate that the maximum impact from the combined plants would be 6 ug/m^3 (5 ug/m^3 from the U. S. Steel Plant and 1 ug/m^3 from the Coho Plant). This combined impact should be considered as worst case, because the maximum increments from each plant generally do not occur at the same receptors. This analysis however has combined the maximum increments. The background levels range from 29 to 45 $ug/m)^3$ based on 1976 and 1977 data. Therefore, the total annual average concentrations would range from 35 to 51 $ug/m)^3$ or well below the standard of 80 ug/m^3.

24-Hour Average SO_2 Concentrations

4.529
The RAMF modeling runs indicate that the combined plants do not cause the 24-hour average PSD increment to be exceeded. Table 4-286 shows the 10 maximum 24-hour average concentrations from modeling the entire year. The meteorological data used in the model were the same as that used in the draft EIS. This was hourly data from Erie Airport that was reduced by the RAMMET preprocessor.

4.530

Table 4-286 shows the the highest 24-hour average increments have occurred at receptors on the western boundary of the proposed U. S.

Table 4- 284

U.S. Steel Annual Average Emission Rates for Particulates (S1) and SO_2 (S2) - (DM Input)

U.S. Steel Annual Average Emission Rates for

Particulates (S1) and SO_2 (S2) - (DM input)

Source Input ID	Km	Km	m	gm	gm	m	m	m/sec	°C
1	538.75	4645.92	0.	.120	0.	10.00	.70	15.00	11.00
2	539.37	4646.18	0.	.100	0.	50.00	.60	15.00	11.00
3	539.48	4645.92	0.	.140	0.	50.00	.70	15.00	11.00
4	537.75	4645.75	1000.00	2.800	0.	10.00	0.	0.	0.
5	537.75	4644.75	1000.00	2.800	0.	10.00	0.	0.	0.
6	538.75	4645.75	1000.00	3.800	0.	40.00	0.	0.	0.
7	538.75	4644.75	1000.00	10.860	.080	20.00	0.	0.	0.
8	538.94	4646.18	0.	.080	0.	40.00	.60	15.00	11.00
9	538.99	4646.13	0.	.920	4.270	30.00	1.50	13.00	200.00
10	538.95	4646.11	0.	.920	4.270	30.00	1.50	13.00	200.00
11	539.06	4646.12	0.	.640	0.	30.00	1.70	13.00	40.00
12	539.17	4645.69	0.	1.970	0.	30.00	3.00	10.00	11.00
13	539.18	4645.63	0.	.040	0.	40.00	.40	15.00	11.00
14	539.32	4645.69	0.	.040	0.	40.00	.40	15.00	11.00
15	539.33	4645.64	0.	.040	0.	40.00	.40	15.00	11.00
16	539.09	4645.55	0.	.860	4.110	50.00	1.50	15.00	55.00
17	539.54	4646.13	0.	.860	4.110	50.00	1.50	15.00	55.00
18	539.32	4645.44	0.	1.420	0.	50.00	1.20	15.00	200.00
19	539.46	4645.12	0.	1.420	0.	50.00	1.20	15.00	200.00
20	539.27	4645.63	0.	6.450	0.	20.00	5.60	10.00	75.00
21	539.55	4644.95	0.	4.000	0.	20.00	5.60	10.00	75.00
22	539.45	4646.07	0.	.360	0.	30.00	1.20	15.00	11.00
23	539.54	4645.95	0.	.360	0.	30.00	1.20	15.00	11.00
24	539.22	4645.50	0.	1.300	.780	100.00	3.50	15.60	343.00
25	539.29	4645.34	0.	1.300	.780	100.00	3.50	15.60	343.00
26	539.36	4645.17	0.	1.300	.780	100.00	3.50	15.60	343.00
27	539.42	4645.01	0.	1.300	.780	100.00	3.50	15.60	343.00
28	539.64	4646.26	0.	.120	0.	50.00	.70	15.00	11.00
29	539.15	4646.71	0.	4.020	0.	50.00	3.80	18.00	40.00
30	539.04	4646.74	0.	8.940	69.500	50.00	1.50	13.00	55.00
31	539.54	4646.09	0.	1.610	0.	30.00	2.40	15.00	11.00
32	539.55	4645.97	0.	1.610	0.	30.00	2.40	15.00	11.00
33	539.94	4646.14	0.	.280	0.	40.00	5.40	15.00	75.00
34	539.85	4646.13	0.	.280	0.	40.00	5.40	15.00	75.00
35	540.04	4646.15	0.	.640	.250	75.00	5.60	16.20	275.00
36	539.77	4646.06	0.	.640	.250	75.00	5.60	16.20	275.00
37	540.02	4646.18	0.	.010	0.	50.00	1.00	15.00	1200.00
38	539.75	4646.11	0.	.010	0.	50.00	1.00	15.00	1200.00
39	539.82	4646.26	0.	.810	.560	30.00	2.00	20.00	75.00
40	539.79	4646.30	0.	1.350	0.	30.00	5.20	15.00	75.00
41	539.71	4646.47	0.	.280	.310	75.00	3.00	20.00	1340.00
42	739.72	4646.45	0.	.280	.310	75.00	3.00	20.00	1340.00
43	539.73	4646.43	0.	.280	.310	75.00	3.00	20.00	1340.00
45	540.02	4646.61	0.	.400	0.	30.00	1.50	10.00	55.00
46	539.98	4646.69	0.	.280	0.	30.00	2.50	15.00	55.00
47	540.10	4646.72	0.	1.560	22.280	50.00	6.00	16.70	760.00
48	540.13	4646.73	0.	1.560	22.280	50.00	6.00	16.70	760.00
49	540.16	4646.74	0.	1.560	22.280	50.00	6.00	16.70	760.00
50	540.18	4646.43	0.	2.080	26.950	50.00	4.40	15.70	760.00
51	540.24	4646.46	0.	2.080	26.950	50.00	4.40	15.70	760.00

Source: Draft EIS

Table 4-234. (Continued)

U.S. Steel Annual Average Emission Rates for

Particulates (S1) and SO_2 (S2) - (DM input)

Source Input ID	Km	Km	m	gm	gm	m	m	m/sec	°C
52	539.11	4645.91	0.	2.580	24.950	50.00	3.70	16.90	149.00
53	539.12	4645.88	0.	2.580	24.950	50.00	3.70	16.90	149.00
54	539.13	4645.86	0.	2.580	24.950	50.00	3.70	16.90	149.00
55	539.10	4645.92	0.	2.580	24.950	50.00	3.70	16.90	149.00
56	539.13	4645.84	0.	2.580	24.950	50.00	3.70	16.90	1490.00
57	539.75	4645.75	1000.00	3.590	0.	10.00	0.	0.	0.
58	539.75	4645.75	1000.00	12.280	12.310	45.00	0.	0.	0.
59	539.71	4646.47	0.	.170	0.	75.00	3.80	15.00	45.00
60	539.72	4646.45	0.	.170	0.	75.00	3.80	15.00	45.00
61	539.73	4646.43	0.	.170	0.	75.00	3.80	15.00	45.00
62	540.36	4645.82	0.	.170	0.	30.00	1.60	15.00	11.00
63	539.33	4645.66	0.	.040	0.	30.00	.40	15.00	11.00
64	540.40	4646.40	0.	.010	.500	40.00	2.00	10.40	435.00
65	539.71	4646.47	0.	.110	0.	75.00	3.00	15.00	45.00
66	539.72	4646.45	0.	.110	0.	75.00	3.00	15.00	45.00
67	539.73	4646.43	0.	.110	0.	75.00	3.00	15.00	45.00

Source: Draft EIS

Table 4- 285

Summary of Source and Emission Parameters
Coho Generating Station

Parameters	Load Conditions		
	50% Load	75% Load	100% Load
Electrical Rating (MW-Net Output)	313	469	625
Stack Height (Ft. above grade)	800	800	800
Stack Diameter (Ft. inside at top)	22	22	22
Elevation of Stack Base (Ft. MSL)	200	200	200
Flue Gas Flow (10^3 ACFM)	1,100	1,650	2,200
Exit Gas Temperature ($^{\circ}F$)	170	170	170
SO_2 Emission (Maximum lbs/10^6 BTU)	1.2*	1.2*	1.2*
Particulate Emission of (Maximum lbs/10^6 BTU)	0.1	0.1	0.1
NO_X Emission of (Maximum lbs/10^6 BTU)	0.7	0.7	0.7
Heat Input (10^6 BTU/hr)	3,083	4,624	6,165
SO_2 Emission Rate (lbs/hr)	3,699	5,549	7,398
Particulate Emission Rate (lbs/hr)	308	462	617
NO_X Emission Rate (lbs/hr)	2,158	3,237	4,316
Ambient Temperature ($^{\circ}F$)	70	70	70

*Reflects operation of SO_2 removal system.

Source: GPU Report

Table 4-286 - 24-Hour Average Highest Sulfur Dioxide Concentrations (ug/m^3), RAMF Output

	Conc.	Month	Day	Receptor No.	Receptor Coordinates	
1	87.24	Aug	220	3	537.30	4645.00
2	82.69	Mar	61	3	537.30	4645.00
3	77.38	Sep	260	3	537.30	4645.00
4	67.71	Apr	111	3	537.30	4645.00
5	66.67	Mar	62	2	537.20	4645.50
6	64.08	Mar	62	3	537.30	4645.00
7	61.82	Sep	260	4	537.30	4644.50
8	61.27	Aug	237	2	537.20	4645.20
9	60.21	Jun	153	3	537.30	4645.00
10	59.11	Aug	220	4	537.30	4644.50

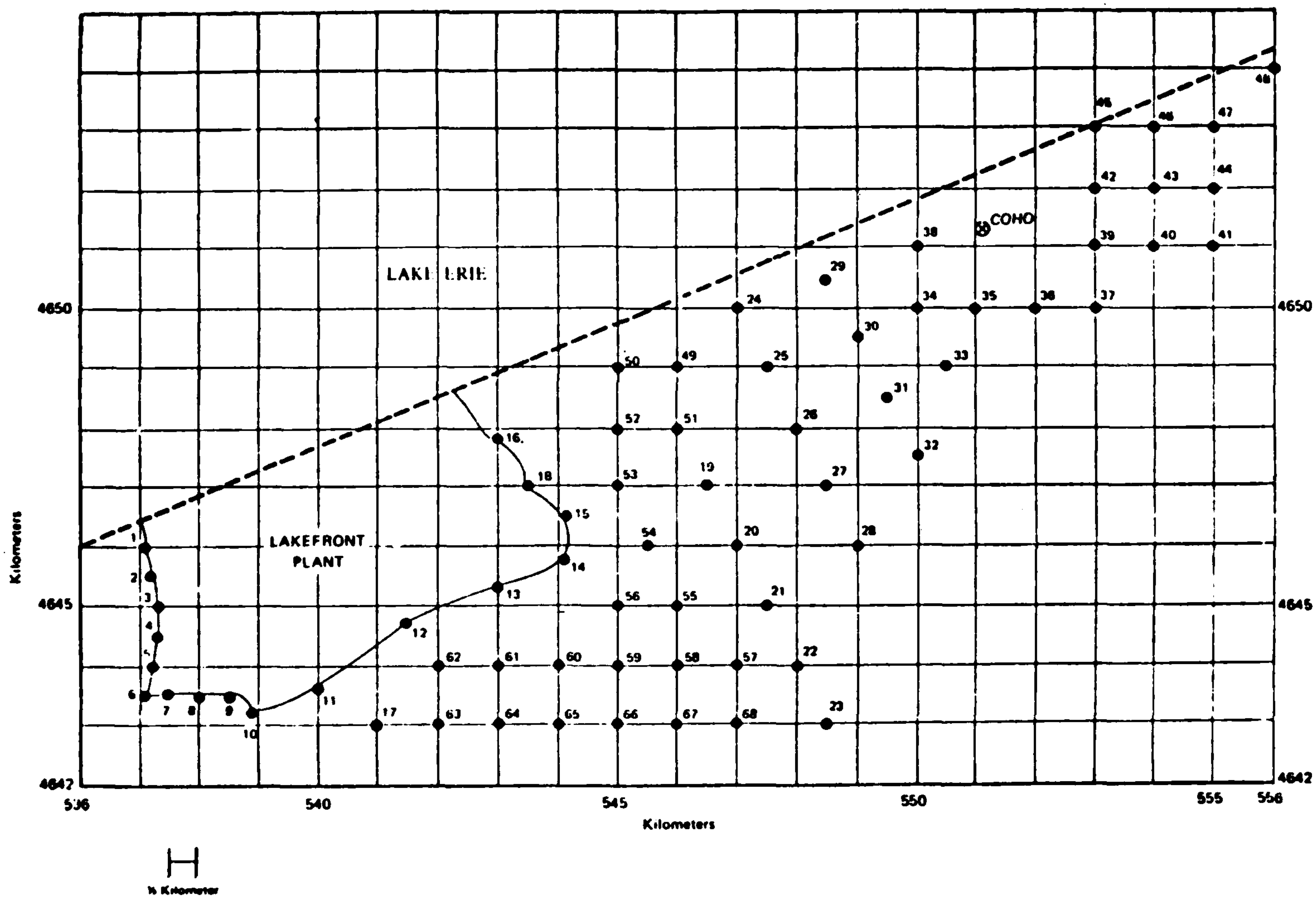


FIGURE 4-70 RECEPTOR GRID FOR MODEL RUNS

Steel Plant (receptors 2, 3, and 4). This is a result of east-northeast winds transporting the emissions from the Coho Plant to the western boundary of the U. S. Steel Plant and adding to the increment from the Steel Plant.

4.531
On Julian day 220 the maximum increment of 87 micrograms per cubic meter was calculated. On this day, 75 micrograms were contributed from the U. S. Steel Plant and 12 micrograms were from the Coho Plant. The other day that was over 80 micrograms (day 61) was reported at 83 micrograms per cubic meter. On day 61, a low boundary layer resulted in no contribution from the Coho Plant because of the high plume rise.

4.532
It appears from the modeling results that the limiting PSD regulation for the region would be the allowable 24-hour maximum. The limiting meteorological conditions would include east-northeast winds, and the closest upwind area to potentially affect the high receptors would be seven kilometers east-northeast in East Springfield. However, any new sources in the East Springfield area would have to be significant to impact the receptors which have used up the greatest PSD increment.

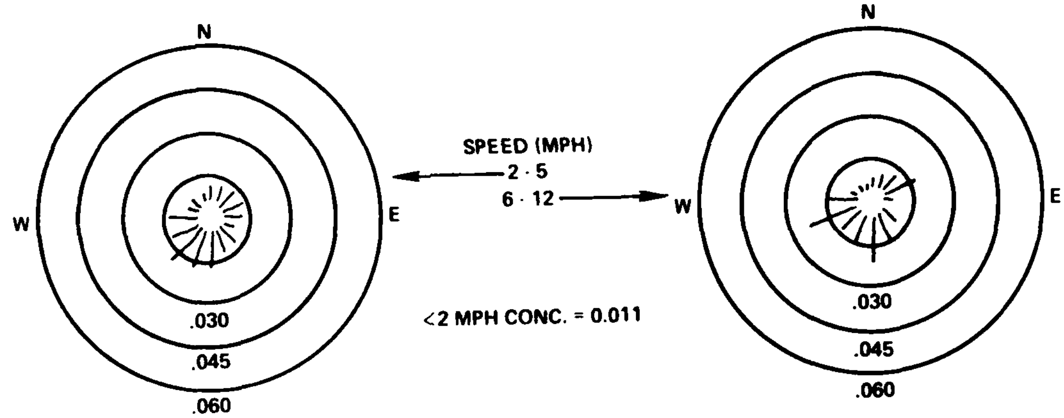
4.533
The maximum 24-hour average background concentration from the State stations was 184 micrograms per cubic meter in Erie. The maximum 24-hour average values for the Conneaut monitors (sites 15 and 16) were 100 and 120 micrograms per cubic meter respectively. Therefore, the maximum 24-hour average total concentrations would range between 187 and 271 micrograms per cubic meter or below the allowed standard of 365 micrograms per cubic meter.

4.534
The pollution rises for the two Conneaut monitors are given in Figures 4-71 and 4-72 for 1977-78 data. These figures indicate that the highest background values occur with west and southwest winds. Therefore, the high backgrounds of 100 to 184 micrograms per cubic meter do not occur during east-northeast winds. Examination of meteorological data indicate that during days of east-northeast winds, the background values are approximately 20 micrograms per cubic meter. During these conditions, the total levels could therefore be 107 micrograms per cubic meter.

POLLUTION WIND ROSES

U.S. STEEL, CONNEAUT
VS STABILITY VS S02 CONCENTRATION PLOT

ROUTE 20 Site 15
APRIL 1977 APRIL 1978



ALL STABILITIES
ALL WIND SPEEDS (MPH)

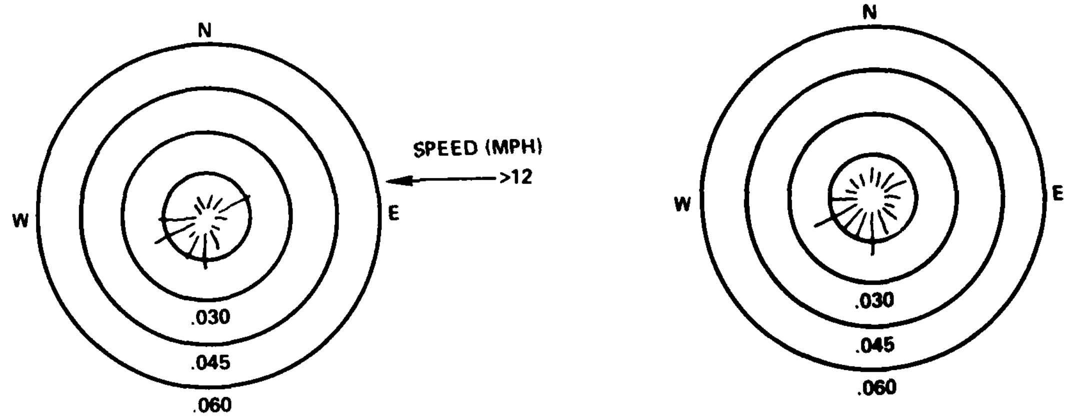


Figure 4- 71

POLLUTION WIND ROSES

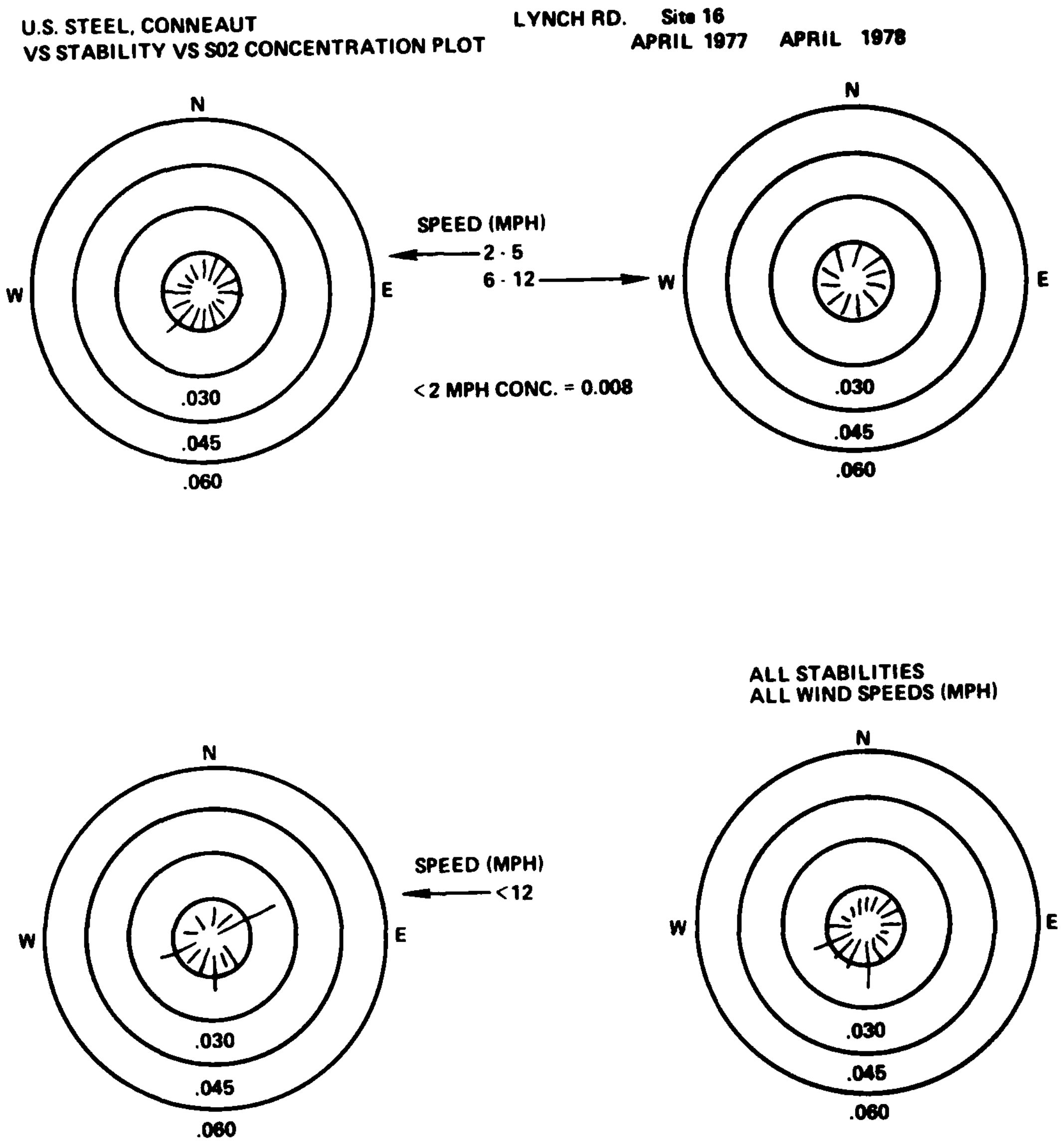


Figure 4- 72

Three-Hour Average SO_2 Concentrations

4.535
RAMF runs for the combined U. S. Steel and coho sources indicated no violations of the three-hour PSD standard of 512 ug/m^3. Table 4-287 shows the one-hour maximum concentrations, which by definition are always greater than or equal to the three-hour maxima. The one-hour maximum concentrations were all within the allowed PSD standard. In all cases, the maximum concentrations occur at receptors near the U. S. Steel facility.

4.536
To further investigate the effects of the combined U. S. Steel, and coho sources, two additional RAMF runs were made using a one-hour averaging time. For these runs, several additional receptors were used, including one at (539.5, 4,643.4), the worst-case location from the previous U. S. Steel's only modeling runs. These runs also used three area-source height classes to allow more precise modeling of the area sources, although this produced only negligible changes in the predicted concentrations. Two days were modeled: day 305, the worst-case day based on the USS-coho screening runs, and day 146, the previous USS-only worst-case day.

4.537
The three-hour average concentrations at critical receptor locations were then computed; the results are presented below:

Three-hour Average SO_2 Concentration for Selected Days,
Day 146,, Critical Receptor 49 at (539.5, 4,643.4)

	Conc Contributions		
Hour	USS	Coho	Total
19	104.2	0	104.2
20	535.6	0	535.6
21	338.8	0	338.8
Average:	326.2	0	326.2

Day 305, Critical Receptor 3 at (53713, 4,645.0)

	Conc Contributions		
Hour	USS	Coho	Total
1	346.3	106.1	452.4
2	42.9	0	42.9
3	199.1	8.7	207.8
Average:	196.1	38.3	234.4

Table 4- 287 - One-hour Average Highest Sulfur Dioxide Concentrations (ug/m^3), RAMF Output

	Conc.	Month	Julian Day (hr)	Receptor No.	Receptor Coordinates (Km)	
1	454.20	Oct	305(1)		537.30	4645.00
2	444.75	Oct	277(2)	16	543.00	4647.80
3	443.06	Mar	63(20)	17	541.00	4643.00
4	441.10	Nov	325(24)	9	538.50	4643.50
5	435.91	Dec	363(6)	3	537.30	4645.00
6	433.81	Aug	237(5)	1	537.10	4646.00
7	433.47	Jun	173(21)	17	541.00	4643.00
8	427.49	May	146(23)	8	538.00	4643.50
9	425.27	Sep	270(19)	10	538.90	4643.30
10	419.87	Jun	158(3)	6	537.10	4643.50

Based on these computations, the highest PSD increment of 326 ug/m^3 occurs on day 146, and includes no contribution from the coho source.

4.538
The maximum background concentrations (one hour) of 350 ug/m^3 added to the maximum increment of 326 ug/m^3 would lead to a total concentration of 676 or well below the three-hour standard of 1,300 ug/m^3.

Lake Breeze Fumigation

4.539
This PSD analysis is concerned with the combined affects of the proposed U. S. Steel Plant and the Coho Power Station. Lake breeze fumigation is a meteorological phenomenon that will not cause additive impacts of the two proposed facilities. The onshore winds occurring during this interval will result in the steel plant and the power plant plumes to be transported inland parallel to each other and separated by approximately 13 kilometers.

4.540
Due to the relatively low level plume heights for the major steel sources, fumigation conditions would not cause the maximum impacts. Most of the pollutant sources will be transported under the boundary layer and will fumigate close to the plant. The three-hour average concentration during fumigation conditions from the proposed U. S. Steel Plant as indicated in Section 4.430 from the fumigation model AQSTM, was determined to be 92 micrograms per cubic meter.

4.541
The table shown below summarizes the results of the modeling of the combined U. S. Steel and Coho Plants for sulfur dioxide. The backgrounds used in determining the total concentrations should be considered as worst-case conditions and probably will not occur during conditions of maximum PSD increments.

Summary of Sulfur Dioxide Maximum PSD
Increments and Maximum Total Ambient Concentrations
From Combined Plants (Micrograms/m^3)

Federal Standard	PSD Standard	Maximum Increment	Maximum Background	Maximum Total Concentration
80 (annual)	20	6	29-45	35-51
365 (24-hr.)	91	87	100-184	187-271
1,300 (3-hr.)	512	326	350	676

4.542
The increases of sulfur dioxide emissions due to secondary growth from the proposed Lakefront Plant were analyzed and it was found that there would be no major incremental increases in annual average sulfur dioxide concentrations for the area. The detailed baseline data used in the above analyses, including the actual computer runs, are on file at the Buffalo District Office.

4.543
The analysis of combined plant impacts was subject to review and comment by the USEPA, Region III Office. The USEPA coordinated this review with the appropriate State agencies in Ohio and Pennsylvania. By letter dated 30 November 1978, the USEPA advised the Corps that the assessment of combined impacts is adequate. However, the EPA also advised that this concurrence does not fulfill all the requirements of EPA's 19 June 1978 PSD regulations and that these PSD requirements must be completed prior to approval to construct the Conneaut facility. At such time as the U. S. Steel Corporation applies for approval to construct the facility under the PSD regulations, more extensive analysis may be required for both total suspended particulate (TSP) and SO_2 impacts of all existing sources and new sources which either consume or expand the PSD, total suspended particulate, and SO_2 impacts of air quality class increments. A copy of this USEPA letter is appended to the final EIS.

Noise Impacts

4.544
The noise impact of the proposed facility will include effects of both construction and operations activities. Each of these will include associated traffic noise in addition to the noise of the activities themselves. A brief outline of the time durations and sequencing of these activities in terms of the proposed two-step process of construction and operation of the proposed plant is given below.

Construction Step I

4.545
This step, extending over a time duration of about 3-1/2 years, is scheduled to include the construction of access roads, the facilities for steel production capacity equal to approximately one-half of the total planned plant production, the attendant railroad lines, and the extension of the pier and dock facilities. Traffic noise during this activity would include rail and truck shipment of construction materials, movements of construction equipment, and the commuting traffic of the construction workers.

Plant Operation Step I

4.546
As the Step I construction activities are completed, the steelmaking operations at Step I production levels will commence. The planned production output during this time will be approximately 3 x 10^6 tonnes per year. The principal noise sources will be the plant process noise associated with the production facilities, the shipping and rail transportation of the production material, and the road traffic associated with the truck transportation of the plant products, and with the commuting workers.

Construction Step II

4.547
Approximately one to 1-1/2 years after the completion of the Step I construction, Step II construction is scheduled to begin. These Step II construction activities will extend over about 3-1/2 years during which time the plant operations will continue at the Step I production levels. Thus, during this time period, the noise associated with the Step I plant operations will be superimposed on the construction noise activities of Step II. The Step II construction will include the completion of the steelmaking and process facilities, a new pier and the associated materials handling machinery, and the associated auxiliary facilities.

Plant Operation Step II

4.548
With the completion of the Step II construction, the proposed plant will be in full operation with a planned production output of approximately 6 X 10^6 tonnes per year. Essentially the same type of noise sources that are associated with Step I will exist at this time, with the total noise output at higher levels indicative of the increase in the number of such sources consistent with the higher product output.

a) Construction Noise

Construction Equipment Schedules

4.549
The maximum equipment requirements during the construction of the plant were given in Table 1-46. As indicated on this table, the maximum requirements for each type of equipment will generally occur at different times during the construction process. For example, the earthmoving equipment will peak during the site clearing operation, and the welding and crane equipment during the building erection

operations. For purposes of calculating the noise generated during the various phases of construction, the number of pieces of equipment arranged by major categories were estimated for each of the three major construction phases: clearing and excavation, foundations, and building erection. The results are shown for Step I in Table 4-288. The assumptions used to develop this tabulation were that the earth-moving equipment (front loaders, backhoes, dragline, bulldozers, graders, scrapers, and tracked vehicles) would reach peak numbers during the site clearing and excavation phases of the work, with limited usage during the latter phases; that compressors, pile drivers, concrete mixers and heavy trucks would reach their maximum utility during foundation preparation; and that cranes and welding machines would be utilized primarily during the facility erection phase. Generators and small trucks would likely have essentially continuous use during the total construction periods.

Equipment Noise Levels and Duty Cycles

4.550

A compilation of construction equipment noise levels and duty cycles for various types of construction and for the separate phases of typical construction projects has been carried out by Bolt, Beranek, and Newman, Inc. for the Environmental Protection Agency. (4-26) In this report, relatively wide ranges of noise levels for the individual equipment types are given. From these data, together with other noise level information, average values, calculated on an energy-average basis, have been determined. The typical duty cycle of these types of construction equipment, defined as the fraction of time that the equipment is operating in its noisiest mode while onsite, is also known or estimated. From these data, an energy-equivalent noise level has been calculated, which is presented in Table 4-289. This value represents the noise source level of each type of equipment, assuming that it is operating continuously during its shift on the site. The noise levels presented in the EPA report referred to above represent data on equipment manufactured prior to the 1970's; as such, relatively little attention was given to noise reduction during its design and manufacture. Currently, there is a major effort underway for the development and promulgation of criteria for noise reduction relating to newly manufactured construction equipment. However, the only Federal standards in existence to date involve portable air compressors and medium and heavy duty trucks. Formal regulatory action has begun for tractors and loaders, rock drills, and pavement breakers, while several types of earthmoving equipment are presently under study for initiation of standard-setting processes in the near future. Further impetus to the reduction of noise levels of construction equipment is due to the growing list of local, State, and Federal standards and practices governing construction site noise and maximum permissible noise levels for classes of equipment. On

Table 4- 238

Units of Construction Equipment in Use

Equipment Type	Construction Step I		
	Clearing and Excavating	Foundations	Building Erection
Crane - Large	-	50	106
- Small	-	20	100
- Tower	-	-	4
Front Loader	13	5	-
Back Hoe/Dragline	59	-	-
Scraper/Grader	50	10	-
Dozer/Tractor	85	20	-
Compressor	60	82	20
Generator	4	4	4
Welder	-	50	615
Pile Driver	-	18	-
Concrete Mixer	-	18	2
Truck - Large	150	235	150
- Small	197	197	197
Total	618	709	1,198

Source: Arthur D. Little, Inc. estimates.

Table 4- 289

Noise Levels and Duty Cycles of Construction Equipment

Equipment Type	Average Noise Level dBA @ 15 Meters	Average Duty Cycle (Fraction of Time)	Equivalent Noise Level dBA @ 15 Meters
Crane - Large	85	0.08	74
- Small	80(1)	0.08	69
- Tower	88	0.04	74
Front Loader	81	0.16(1)	73
Back Hoe/Dragline	86	0.16	78
Scraper/Grader	89	0.12(1)	80
Dozer/Tractor	90	0.16	82
Compressor	85	1.00	85
Generator	80	0.40	76
Welder	75(1)	1.00(1)	75
Pile Driver	100	0.04	86
Concrete Mixer	84	0.40(1)	80
Truck - Large	90	0.16	82
- Small	75(1)	0.16	67

(1) Arthur D. Little, Inc. estimates.

Source: Bolt, Beranek and Newman, "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances," Contract 68-04-0047 for the USEPA, December 31, 1971.

the Federal level, the General Services Administration issued noise control requirements effective 1 January 1975, listing maximum allowable noise levels for construction equipment for work at Federal sites under contract with the GSA. These allowable levels, shown on Table 4-290, are generally from five to as much as 15 dBA below the levels given in Table 4-289.

4.551
Similarly, several States and cities have issued regulations governing construction site noise, and construction equipment operation and sales. The Construction Industry Manufacturers' Association has pursued a program over the past several years to develop standards and techniques for noise reduction for construction machinery. Although these developments are primarily intended to reduce the noise exposure to the operators of the machines, the effect is that the noise levels of the machines will also be reduced at distances beyond the property line. Based on the extent of these ongoing efforts in noise reduction, there is some question as to whether or not the use of the data given in Table 4-289 pertaining to pre-1970 construction equipment, is realistic for analyses of construction activity projected for the 1980-1982 and 1985-1986 time periods. At least some of the construction machinery used at the proposed plant would be of recent manufacture and will likely incorporate some noise reduction features. The scale of the proposed project, however, would suggest that a large number of older items of equipment would also be utilized, so that the overall effect on the average noise levels may not be significant. Therefore, the applicant considers the noise levels reported in Table 4-289 to be conservative. Combining the data given in Tables 4-288 and 4-289 leads to estimates of the construction noise levels of each group of equipment types for each of the three phases of construction. These estimates are based on the assumptions that each of the types of equipment generates noise levels as given in Table 4-289 and that the total noise output by type is given by the energy summation over the total number of each type of equipment. The total equivalent noise level for each of the construction phases is then determined by summing, again on an energy basis, the contributions of each type of equipment. The results of this procedure are reported in Table 4-291 which shows the total equivalent noise level to be 109 dBA at 15 meters for the clearing and excavation and for the foundations phases, and 108 dBA during the building erection phase.

Distribution of Construction Activity and Construction Noise Sources

4.552
The construction activity for the proposed plant will, as previously indicated, be distributed into two steps, each of approximately

Table 4- 290

General Services Administration, Public Buildings Service Construction Equipment and Practices(1)(2)(3)

Equipment	Effective Dates: July 1, 1972	Effective Dates: January 1, 1975
Earthmoving		
front loader	79	75
backhoes	85	75
dozers	80	75
tractors	80	75
scrapers	88	80
graders	85	75
truck	91	75
paver	89	80
Materials Handling		
concrete mixer	85	75
concrete pump	82	75
crane	83	75
derrick	88	75
Stationary		
pumps	76	75
generators	78	75
compressors	81	75
Impact		
pile drivers	101	95
jack hammers	88	75
rock drills	98	80
pneumatic tools	86	80
Other		
saws	78	75
vibrators	76	75

(1) These are noise control requirements which apply to work at sites of Federal Government structures under contract with the General Services Administration (Par. 44.8 in Guide Specification PBS 4-01100, October 1973).

(2) Equipment to be employed ... shall not produce a noise leve' exceeding the following limits in dB(A) at a distance of 50 fee. .rom the equipment under test.

(3) The Contractor shall comply with all applicable state and local laws, ordinances, and regulations relative to noise control.

Stationary equipment may be provided with acoustical enclosures to provide the required sound attenuation subject to continued maintenance of such enclosures to assure that maximum sound levels specified are not exceeded.

Where field sound measurements reveal sound levels exceeding those listed above, Contractor shall cease operating such equipment and repair or replace it with equipment complying with these sound levels.

Source: General Services Administration, "Guide Specification," PBS4-01100, Par. 44.8, October 1973.

Table 4- 201

Estimated Construction Noise Source Levels -- Step I

Equipment Type	Clearing and Excavation	Foundations	Building Erection
	Number of Equipment Types and Equivalent Noise Levels (dBA, at 15 Meters)		
	Construction Phase		
Crane - Large	-	50 @ 74 = 91	106 @ = 94
- Small	-	20 @ 69 = 82	100 @ 69 = 89
- Tower	-	-	4 @ 74 = 80
Front Loader	13 @ 73 = 84	5 @ 73 = 80	-
Backhoe/Dragline	59 @ 78 = 96	-	-
Scraper/Grader	50 @ 80 = 97	10 @ 80 = 90	-
Dozer/Tractor	85 @ 82 = 101	20 @ 82 = 95	-
Compressor	60 @ 85 = 103	82 @ 85 = 104	20 @ 85 = 98
Generator	4 @ 76 = 82	4 @ 76 = 82	4 @ 76 = 82
Pile Driver	-	18 @ 86 = 99	-
Welder	-	50 @ 75 = 92	615 @ 75 = 103
Concrete Mixer	-	18 @ 80 = 93	2 @ 80 = 83
Truck - Large	150 @ 90 = 104	235 @ 90 = 106	150 @ 90 = 104
- Small	197 @ 67 = 90	197 @ 67 = 90	197 @ 67 = 90
Total Equivalent Noise Levels by Phase, LEQ at 15 Meters	109	109	108

3-1/2 years' duration, with the more intense activity concentrated in a period of about 1-1/2 years. The activity will be distributed over a relatively large area, in excess of 1,000 acres, so that from an environmental noise viewpoint, consideration must be given to the major centers of construction within the proposed plant and to the relative distribution of construction equipment among these centers. Based on the consideration of the proposed layout of the principal steelmaking processes in the plant area, together with the measurement locations used in defining the ambient noise climate, four major construction centers were identified within the proposed plant which would reasonably define the total construction noise. These construction noise source centers are shown on the site map, Figure 4-73. Also shown in this figure are the eight receptor locations used in the ambient noise climate measurement survey. The first center would account for the noise associated with the construction of the power house, blast furnaces, sinter plant, water intake and treatment plant, and steelmaking plant. The second major noise source includes the coke ovens, by-products plant, coal blending, and slag operation and storage. The third center, located in the strip and plate operations, would include the casting, plate mill, oxygen plant, strip mill, and strip finishing buildings. The fourth center, located at the port area, would include the construction of the port facilities, including the new pier, the extension of the existing pier, dredging, and the coal and raw material storage areas.

4.553
Based on the construction manpower distribution given in Chapter One and the average of both construction steps, the port construction will involve about five percent of the labor force while other three centers will each involve about 30-32 percent. The applicant assumed that the usage of construction equipment will be proportional to the manpower allocation. An exception to this rule will exist for the port construction, where the use of equipment such as dredges, pile drivers, etc. will likely involve a relatively low ratio of manpower to equipment. Accordingly, the applicant estimates that 10 percent of the construction equipment will be utilized in port construction and the remaining 90 percent will be divided equally among the other three noise centers. On this basis, the total noise source levels proportioned among each of the four construction centers for Step I for each of the construction phases (assuming that the total equivalent noise level per phase is 109 dBA) are as follows:

Noise Centers Nos. 1, 2, and 3 = 104 dBA;
Noise Center No. 4 = 99 dBA.

4.554
These levels are the energy equivalent, LEQ levels during the construction workday. For the construction activities of Step II,

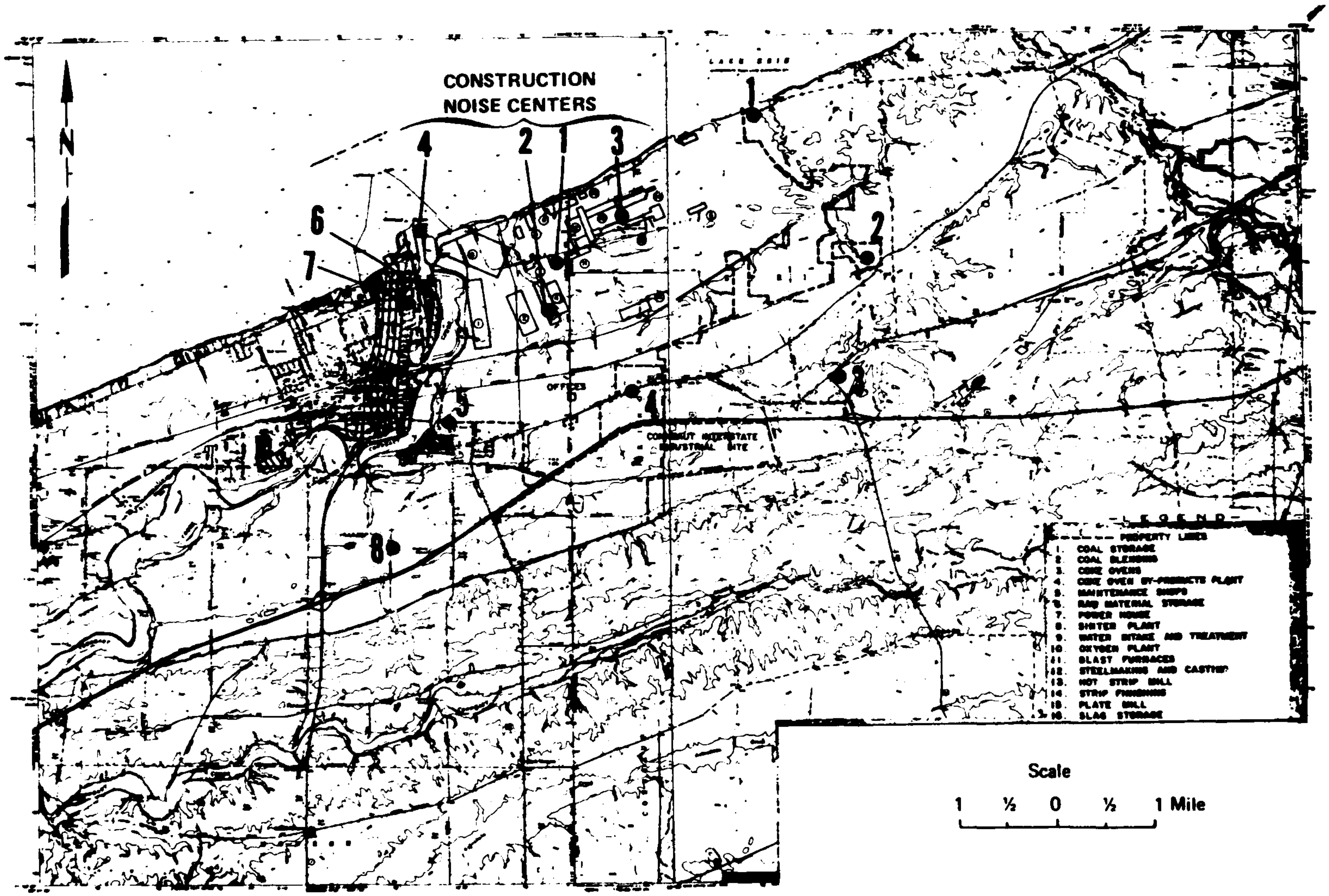


FIGURE 4– 73 CONSTRUCTION NOISE CENTERS 1 THROUGH 4 AND RECEPTOR LOCATIONS 1 THROUGH 8

the noise source levels will be two dBA lower than these given for Step I, on the assumption that the construction activity, based on the manpower estimates, will be approximately 60 percent of that of Step I.

Projected Noise Levels at Receptor Locations

4.555
The projected noise levels due to construction activities at each of the measurement locations around the periphery of the plant site are obtained by adding the contributions from each of the major construction centers as received at each of the measurement locations. Each of the noise sources will be attenuated due to geometric spreading of the noise energy and due to the air absorption of the noise energy. Spreading loss is six dBA per doubling of distance, while the air absorption is commonly assumed to be one dBA per 300 meters (1,000 feet). Additional attentuation due to ground absorption and vegetation is ignored for conservatism. A summary of the noise levels calculated for each of the eight noise receptor locations from all four noise source centers for the Step I construction activities is given in Table 4-292. For Step II of construction, the total construction noise levels at each of the receiver locations would be two dBA less than those given in Table 4-292. Taking the time duration into account, the construction noise when added to the existing noise climate results in the total predicted noise as given in the last two columns of Table 4-292. As indicated on this table, the predicted noise levels at the receptor locations on the plant periphery due to the construction activities of the proposed plant will not be significantly above the current noise levels measured at those locations. The only increases greater than one dBA will occur at Sites 6 and 7 in the northeast corner of Conneaut, where the port construction activities would produce a two to three dBA increase in the equivalent noise levels. However, the day-night noise levels, LDN, will not change because this measure is sensitive primarily to the nighttime noise levels. In summary, the noise levels of the proposed plant construction at receptor locations on the periphery of the site area will not be significant. The existing noise climate, as discussed earlier in this assessment, is due to road and rail traffic at most locations, and due primarily to the port and dock operations for the locations in Conneaut. The principal reason for this small effect is that the distances from the major centers of construction to the plant periphery are substantial. That is, although the construction noise source levels are quite high, the attenuation of these levels due to distance spreading effects is large enough to reduce the received noise levels to values near the existing noise levels.

Table 4-202

Noise Levels (dBA) at Receptor Locations Due to
Step I Construction Noise Sources

Receptor Location	Existing Noise Climate		Construction Noise (1)	Total Predicted Noise	
	LEQ	LDN	(LEQ-8 hrs)	(LEQ)	(LDN)
1	50	56	51	51	56
2	54	63	44	54	63
3	57	64	44	57	64
4	60	66	57	60	66
5	54	63	53	55	63
6	61	70	62	63	70
7	56	64	61	59	64
8	54	62	43	54	62

(1) Step II levels are 2 dBA less.

b) Operations Noise

Existing Noise Level at a Similar Plant

4.556
The method used by the applicant to predict the process generated noise output of the proposed facility involved the measurement of the noise output of an existing similar steel plant. The existing steel plant most closely resembling the proposed Lakefront facility is the U.S. Steel Fairless Works located in Fairless Hills, PA. The general arrangement of this plant is shown in Figure 4-74. Comparison of the Fairless Works with the proposed facility must be made on a broad scale. The fine details of specific production equipments such as the size of a particular air blower or electric drive motor for a rolling mill stand must be overlooked since there is no exact comparability to the equipment which will be used in the Lakefront Plant. The applicant states there is reasonable correspondence in terms of broad measures of noise generation such as total installed electric motor horsepower, volume of materials handled, product throughput and ore reduction to metal.

4.557
The noise level measurements at the Fairless Works were made during a four-day period, Wednesday through Saturday, 6-9 July 1977. (4-26a) The major objectives of the measurements were as follows:

1. To define typical noise levels and diurnal variations in these noise levels at several representative locations around the perimeter of the Fairless Plant property.

2. To define typical day to day variations of these noise levels.

3. To identify major noise sources within the Fairless Plant and to quantify these sources in terms of overall level and spreading characteristics.

4.558
To accomplish the first two objectives, measurements were taken at three different locations during both day and nighttime hours over the four-day test period. To achieve the third objective, two other locations were used to assess the plant noise level at relatively large distances, and the remaining measurement locations were used to quantify major noise sources within the plant boundaries. Altogether a total of 19 locations were used. The measurements were planned to quantify the emission levels (at a standard distance) for those types of major processing units at Fairless that would also exist at the proposed facility. Such scheduling also allowed elimination of other

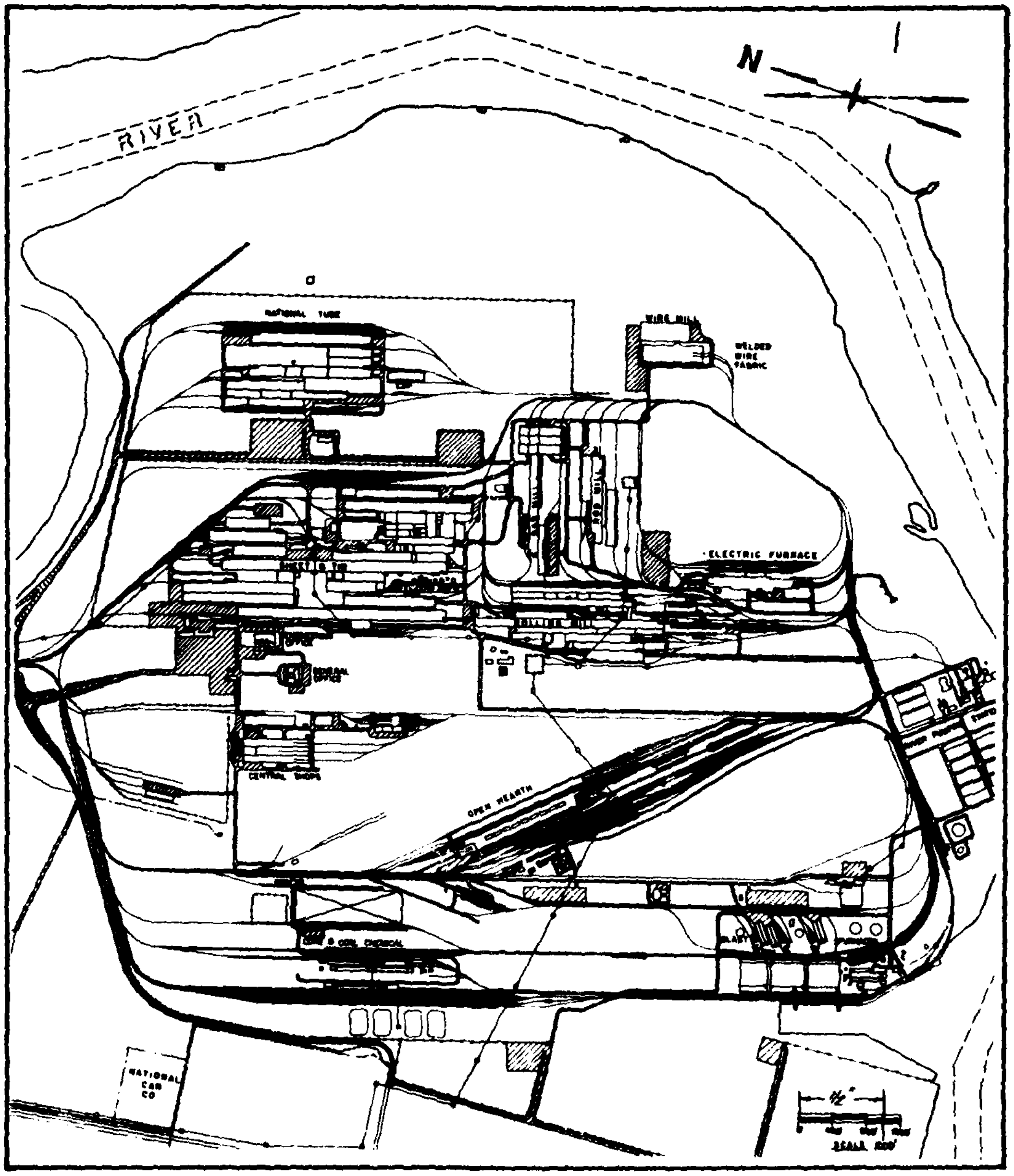


FIGURE 4– 71 U.S. STEEL FAIRLESS WORKS, PENNSYLVANIA

types of major units that would not be duplicated in the new plant. Listed in Table 4-293 are the various production units measured at Fairless with their respective emission levels (at 100 meters). Most of these levels were determined by direct measurement of a unit that could be isolated acoustically. The pipe mill level was determined by measurements with and without the mill in operation. The rolling mills level had to be inferred because of its very large size and the inability to separate this source from the entire Fairless facility noise level. Neither the continuous casters nor the electric furnaces were in operation during the measurement period. As a check on the validity of these individual source levels, the total Fairless noise level at three far field measurement locations (1.5 to 1.8 km from the geometric center of the plant) were calculated using the levels shown in Table 4-293. The calculated levels differed from the measured levels by 2.7, 1.1 and 0.7 dB, respectively. This comparison indicates that the far field levels can be predicted with reasonable accuracy by using the individual unit source levels.

Predicted Noise Levels at the Proposed Site

4.559
A method of predicting the far field noise levels around the proposed facility is the concept of an acoustic center. The acoustic center is the one theoretical location where all of the individual noise sources are situated. At large distances, i.e., beyond two kilometers (6,600 feet), the noise level so calculated will be identical to the level calculated by using the actual location of individual sources. At the proposed facility, all of the major noise sources are within a radius of 1,250 meters (4,100 feet) from a location which is halfway between the blast furnaces and the power house. It was determined that it is appropriate to consider that this location, midway between the two largest noise sources identified, is the acoustic center for the proposed plant.

4.560
For the proposed plant, the following scaling methods have been selected. In the blast furnace and power plant complex the instantaneous reaction volume of a furnace is believed to be the appropriate measure of the noise generated. At the air separation plant, the oxygen production capacity determines the mechanical power required which, in turn, is the measure of noise generated. The coke and by-products plant and the sinter making process are scaled by volume throughput. Rolling mills have been scaled by the amount of installed electric motor horsepower since the energy needed to reduce metal in thickness is eventually dissipated as frictional heat and acoustic energy. Although the capacity of the proposed mills, in tonnes per year, is twice that of the Fairless plant, more metal is shipped in thicker shapes. The basis for scaling the steel making

Table 4-293

Noise Source Emission Levels of the Fairless Works

Source	Noise Level at 100 Meters (dBA)
Power Plant and Blast Furnace Complex	78
Sinter Plant	68
Open Hearth Furnaces	60
Coke Plant (one battery of two)	68
Air Separation (Oxygen) Plant	64
Pipe Mill (not in proposed plant)	63
Wire Mill (not in proposed plant)	Negligible
Rod and Bar Mills (not in proposed plant)	69
Rolling Mills	70
Water Intake and Treatment	Negligible
Continuous Casters	Negligible
Electric Furnace (not in proposed plant)	Not Measured

process is unclear since the processes compared are distinctly different. Although each open hearth furnace of Fairless operates at a slower metal production rate than a Q-BOP furnace of the proposed plant, there are many more individual furnaces at Fairless. Lacking better definition, the scaling has been selected on the basis of total throughput. A summary of these scaling procedures and combined plant source levels is shown in Table 4-294. The result that the proposed total plant level is three dB higher than the Fairless Plant level is consistent with the result obtained from a more general approach based on the scaling of total throughput alone.

4.561
Assuming that the production rate is constant over any 24-hour day, this calculated level of 83 dBA is equal to the LEQ(24) level for the Step II plant process noise at a standard distance of 100 meters (330 feet). The corresponding LDN, or day-night level, is 89 dBA. The resulting noise levels at the eight measurement locations around the site area are obtained by calculating the corresponding reductions in the source level due to propagation losses and are as shown in Table 4-295. In only one instance, Location 7 in Conneaut, does the process noise contribute to the existing conditions, and only in the amount of one dB for the LEQ(24) measure. Except for this location, the plant process noise is more than 10 dB lower than any existing noise level measured. During Step I operations, at approximately one-half of the steel production rate, the combined plant noise emission level would be 80 dBA. There would be no change in the present noise climate due to Step I process noise.

c) Transportation Noise

Air and Rail Traffic Noise

4.562
The four sources of transportation noise are air, rail, water, and highway operations. As stated in the previous sections of the Traffic and Transportation impacts, air traffic generated by the project will be negligible. The baseline rail traffic for 1990 will be an average of 166 trains per day. The project will add to this total a peak of 8.24 trains per day. This 5.0 percent increase in rail traffic will have negligible effect on the area noise levels.

Highway Traffic Noise

4.563
The methodology used for determining traffic noise was conceived by the Transportation Systems Center (TSC) of the Department of Transportation and published in 1972 as a "Manual for Highway Noise Prediction." While this methodology is regarded as approximate,

Table 4- 204

Predicted Source Emission Levels of the Proposed Lakefront Plant
Process Sources -- Step II at 100 Meters

Source	Proposed Vs Fairless Comparison, Approximate		Scaling Factor (dB)	Measured Fairless Levels (dBA)	Predicted Proposed Plant Levels (dBA)
Power Plant and Blast Furnace Complex	Reaction Volume	2½:1	+4	78	82
Sinter Plant	Throughput	2:1	+3	68	71
Steel Making Furnaces	Throughput	2:1	+3	60	63
Coke and By-Products	Throughput	2:1	+3	68	71
Air Separation (Oxygen)	O_2 Requirements	4:1	+6	64	70
Rolling Mills	*Installed* Horsepower	1:1	0	70	70
Water Intake and Treatment	---		-	Negligible	Negligible
Continuous Casters	---		-	Negligible	Negligible
Combined Plant Sources				80	83

Table 4- 295

Comparison of Existing and Predicted Noise Climate
Due to Step II Process Noise
(dBA)

Location	Existing Noise Climate LEQ(24)	Existing Noise Climate LDN	Process Noise Alone LEQ(24)	Process Noise Alone LDN	Predicted Climate With Process Noise LEQ(24)	Predicted Climate With Process Noise LDN
1	50	56	38	44	50	56
2	54	63	31	37	54	63
3	57	64	32	38	57	64
4	60	66	47	53	60	66
5	54	63	43	49	54	63
6	61	70	49	55	61	70
7	56	64	48	54	57	64
8	54	62	30	36	54	62

The traffic on the I-90 access link will increase the noise levels in the uninhabited corridor of its right-of-way.

4.565
Relative to the highway network in the project area and the Design Noise Level/Activity Relationships given in the FHWA's Program Manual, 7-7-3, (4-28) the discussion in the Noise Climate baseline section of Chapter 2 assigned activity categories to the eight measurement locations. By application of the definitions of the various activities, routes SR-7 and US-6N are assigned the Activity Category C, although no present activity exists. This information is summarized in Table 4-296 which also includes a comparison of the worst case predicted noise levels of Figure 4-75, I-90 Direct Access, with the Design Noise Levels of 7-7-3. As the comparison in Table 4-296 indicates, the I-90 direct access plan is acceptable from the point of view of noise impacts. The access link itself, assumed centrally aligned within the site boundaries, would create no noise impact. Also, assuming a judicious routing of the eastern access road, any noise impact would affect only those nearest few residences now situated on SR-5 and US-20. The L10 design noise level of 75 dBA for Category C would not be exceeded however. An alternative assessment of the traffic noise impact may be developed by referring to Figure 4-77. In this figure the change in noise levels gives an indication of the potential reaction of roadside inhabitants. The I-90 direct access plan limits all increases of roadside noise levels to undetectable amounts of zero to three dBA. Location 3, at the intersection of US-20 and US-6N, may experience an increase somewhat above three dBA due to the intersection. Reliable methods of determining accurate noise levels at intersections have not been developed. Since Interstate Route I-90 has very few abutting residences in the Ohio Link, the three dBA increase would not be significant.

Water Transportation Noise

4.566
The source of water transportation noise in the project area is the ship bulk handling facilities in the industrial area at the port in Conneaut. Measurement Location 7 at the corner of Pearl and Day Streets was the receptor location chosen in the ambient noise survey at a representative location in order to assess any impact due to port operations. The 1990 baseline port traffic of 4.51 ships per day would be increased by 1.15 ships per day due to Step II operations of the project. This 25 percent increase in traffic represents a corresponding increase in the amount of bulk handling of pellets, ore, and limestone, but not coal, since the coal required by the project arrives in the area by rail. This distinction is significant because the pellet, ore, and limestone unloading docks are twice as

Table 4- 296

Comparison of I-90 Direct Access Predicted Worst Case with
Design Noise Levels -- L10
(dBA)

Location and Description	Assigned[1] Activity Category	Design[1] Noise Level (Hourly)	Design Noise Level Exceeded?
1. Park Area, Elmwood Road	A	60	- No project traffic -
2. Residential, SR-5	B	70	No
3. Developed, US 20 and 6N	C	75	No
4. Developed, US 20	C	75	No
5. Rowe School	B	70	No
6. Industrial, Conneaut	C	75	- No project traffic -
7. Residential, Conneaut	B	70	- No project traffic -
8. Residential, Dorman Road	B	70	No
State Route 7	C	75	No
US Route 6N	C	75	No

(1) From Federal Aid Highway Program Manual. Vol. 7, Chapter 7, May 14, 1976.

far away from Location 7 as the coal handling docks which means their contribution to the total noise level at Location 7 is less than the contribution of the coal handling docks. The ambient noise survey at this location, however, does not separate the noise effects of the individual bulk handling operations. Therefore, a very conservative approach has been taken in this particular analysis by assuming that the potential increase in the 1990 noise level at Location 7 is proportional to the 25 percent increase in traffic. The 1977 port traffic is 2.56 ships per day while the 1990 baseline port traffic is estimated at 4.51 ships per day. Thus, the plant operations would increase this traffic by 1.15 ships for a total of 5.66 ships per day. Similar to the scaling procedures used in determining the plant process noise earlier in this section, it is assumed that the increase in noise level is equal to ten times the logarithm of the relative energy consumed in handling the bulk materials. In this case, the relative energy used is assumed to be the same as the relative number of ships per day. Accordingly, the baseline port traffic would increase the noise level at Location 7 from 1977 to 1990 by 2.5 dBA. Further, the 1990 plant traffic would increase the 1990 baseline noise level by one dBA. Considering the conservatism described above, the applicant concludes that the incremental noise impact at Location 7 due to the plant ship traffic would be negligible.

Hydrologic Regime

Effects on Water Quality

a) Primary Impacts

Construction

4.567
The extensive construction activity required for the proposed plant would have adverse impacts on the surface waters near the project site. The surface waters that would be impacted during construction include Lake Erie (including Conneaut Harbor), Turkey Creek, Conneaut Creek, Raccoon Creek, a few small unnamed tributaries to Lake Erie on the proposed project site, and several small ponds on the proposed project site. The type of water quality impacts associated with these activities are listed below:

- Disturbances in water chemistry, which occur through the resuspension of chemically reduced sediments in the oxidizing water body;

- The addition of suspended solids from dredging or runoff;

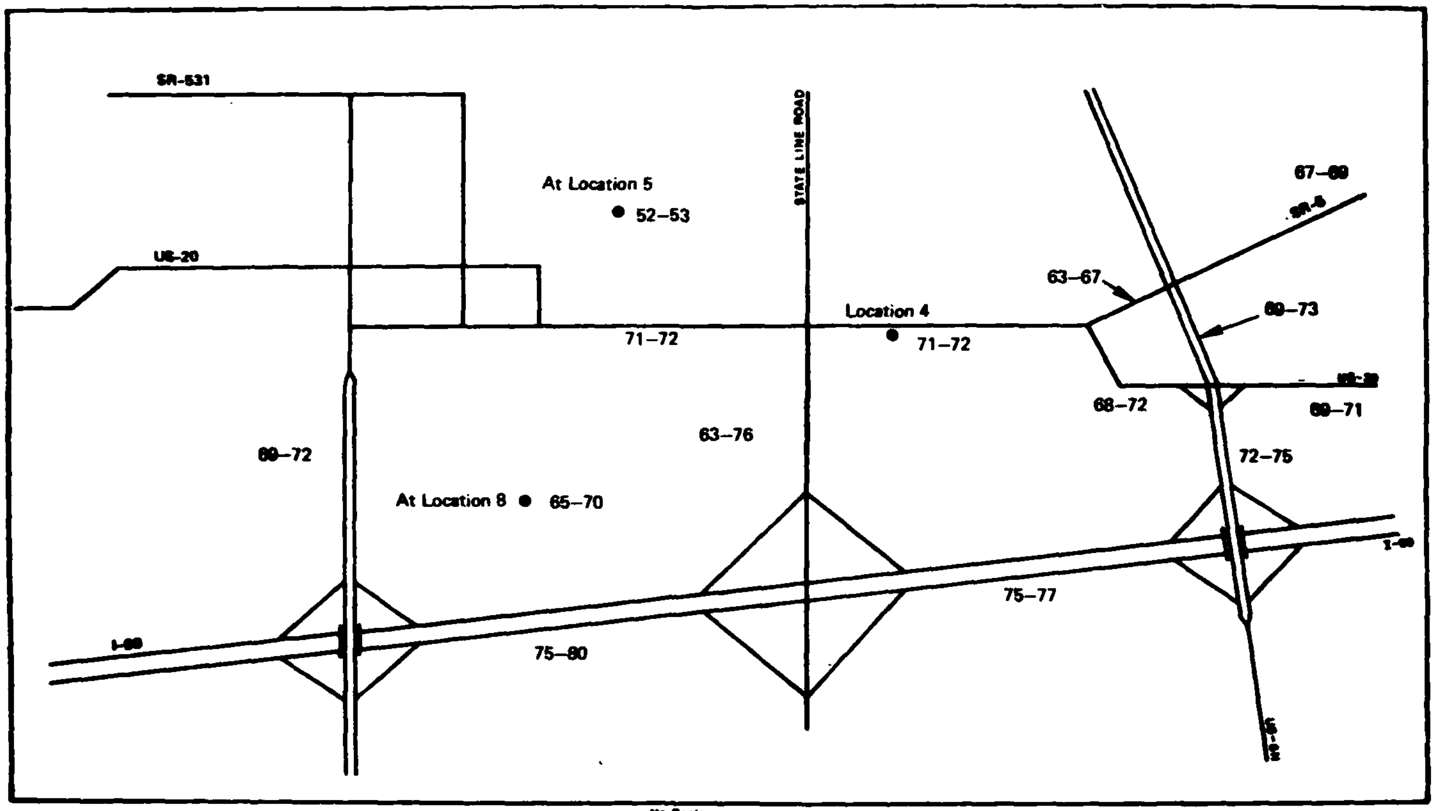


FIGURE 4– 75 RANGE OF VEHICULAR TRAFFIC NOISE LEVELS, L10 IN dBA, 7AM – 3PM AT 30M, (100 FT) FROM ROADWAY EDGE FOR ALL PROJECT YEARS (I–90 DIRECT ACCESS)

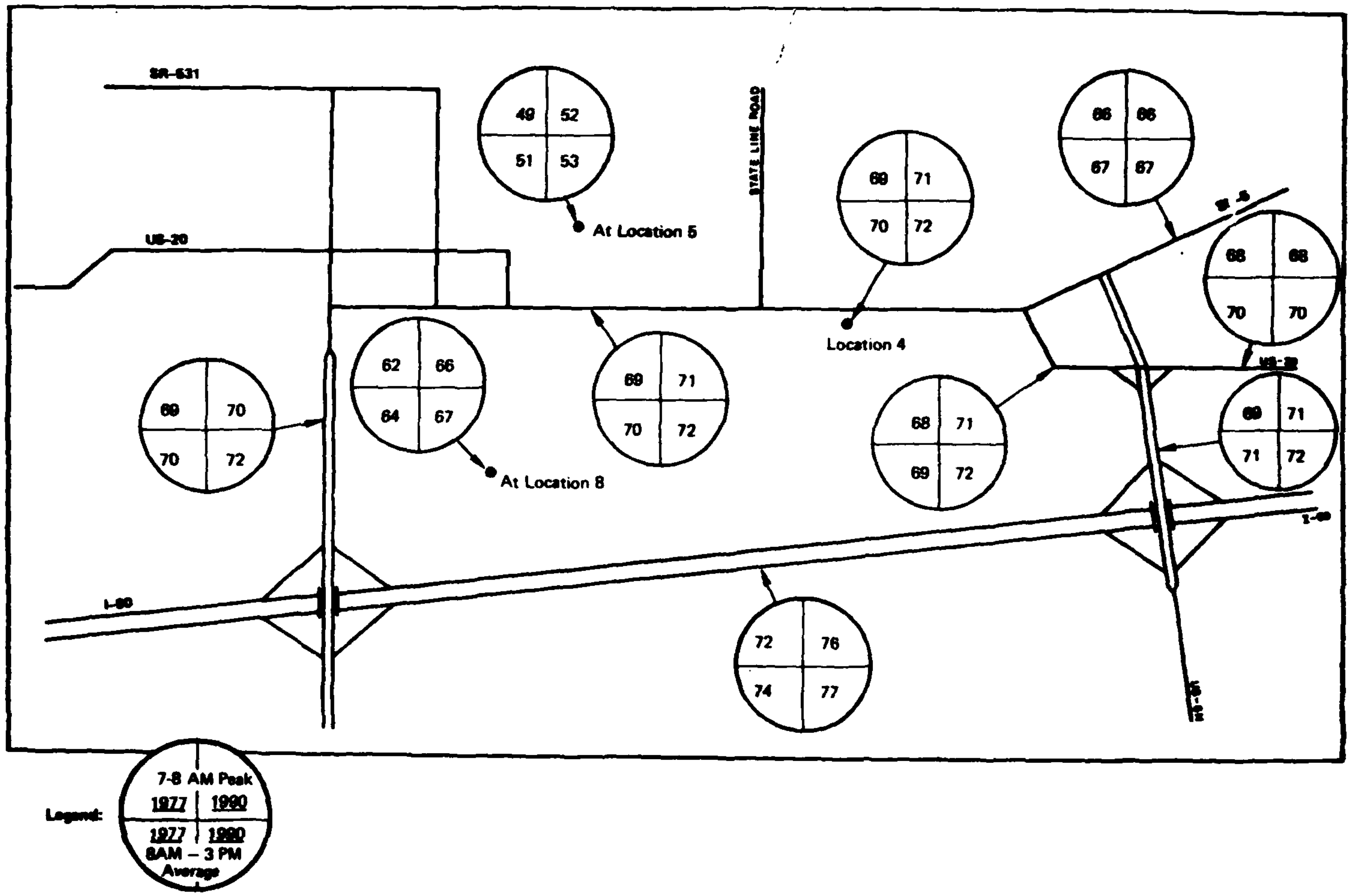


FIGURE 4–76 BASELINE VEHICULAR TRAFFIC NOISE LEVELS, L10 IN dBA, AT 30M, (100 FEET) FROM ROADWAY EDGE

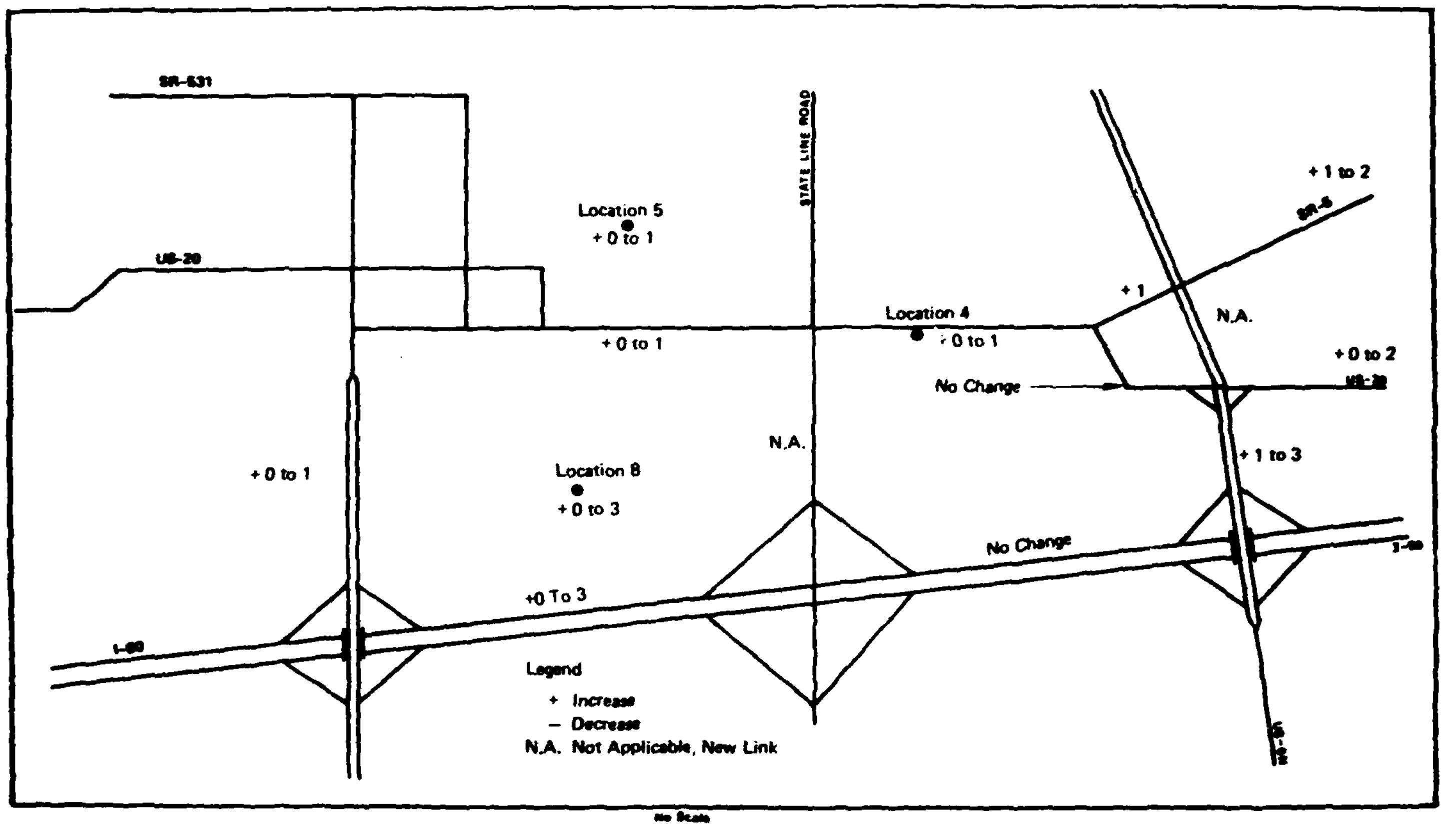


FIGURE 4– 77 CHANGE IN VEHICULAR TRAFFIC L10 NOISE LEVELS, dBA, 7 AM – 3 PM.; PROJECT COMPARED TO BASELINE FOR 1990 (I–90 DIRECT ACCESS)

- Altered flow patterns related to obstructions in the lake or culverting of Turkey Creek and increased or modified runoff patterns;

- Higher water temperatures (in summer) in those creeks where vegetation removal causes a loss of shade. Since the applicant's current proposal specifies that a greenbelt will remain around most of the upper portion of Turkey Creek, temperature increases in Turkey Creek due to devegetation will be minimal.

- Possible addition of fertilizers, pesticides, and herbicides carried by runoff.

4.568
The initial time frame for these impacts is on the order of 10 years. The first step would involve site preparation: clearing, grubbing, removal of vegetation, and grading; this would involve some 1,100 acres and about six months duration. Watershed diversions, would also be part of the initial step. The applicant no longer intends to fill Turkey Creek tributaries and divert the remaining portion into a storm water diversion channel, as described in the draft EIS. Instead, 7,500 feet of the main stem will be culverted and consequently shortened by 1,900 feet. The subsequent construction of the plant would take place in two steps of about 3-1/2 years duration each.

Impacts on Lake Erie

4.569
Impacts on Water Quality Due to Pipeline Construction. The duration of intake and outfall pipeline construction activities would probably be one lake season (April through November) and will be completed during Step I of plant construction. Laying of the pipelines for the main water intake and waste water outfall would require dredging and blasting of the lake bottom. These activities would result in the resuspension of bottom sediments and concommitant increases in turbidity. Based on the 1977 measurement of sediment quality, the redistribution of dredged material in the water column could result in an increase in BOD (thus lowering the level of dissolved oxygen), a decrease in pH of the water, and a release of nutrients and other substances, such as heavy metals. Contaminants such as heavy metals can be redistributed when sediments are disturbed. Metals, oils, grease, and other toxic materials present in typical lake sediment can be damaging to aquatic organisms at high concentrations or long exposure times. Sediments analyzed from the area near the pipelines (LE_5-LE_9), exceed recommended EPA Region V criteria for lead, zinc, mercury, TKN, ammonia, iron, and nickel. While it is difficult to

predict the effect of redistributing these sediments in an area such as this where sediment amounts are small and flushing is good, effects on water quality and aquatic biota are not expected to be large.

4.570
Due to the presence of a rocky bottom, it would be necessary to blast in order to excavate for the pipeline. A pattern of small-diameter holes would be drilled for the explosive charges. The charges would be placed in the holes and subsequently detonated. Detailed project plans have not been developed by the applicant. However, it is likely that blasting patterns will be arranged in such a way that rock is only reduced to a size which will permit removal by excavation equipment. The rock substrate will not be pulverized during the blasting operation since this could cause widespread sedimentation and adverse effects on ambient water quality. The blast will be detonated in the rock rather than in the water, and most of the energy will be absorbed in fracturing of this material. It is likely that the actual excavation will cause limited resuspension of sediments since much of the material to be removed would be in large chunks and a very small proportion is expected to be in the silt and clay-sized fraction. Some introduction of fine material into the water column may also occur during backfilling over the laid pipe. Changes in water quality due to blasting and dredging have not been quantified by the applicant. Currents in the vicinity of the proposed pipelines right-of-way are variable and influenced by the breakwater at Conneaut Harbor. Under nonstorm conditions the magnitude of the current is generally less than 20 centimeters per second and characteristically lies in the five to 20 centimeters per second range. Under these conditions resuspended sediments sand size and larger materials will fall to the bottom within meters of the location of resuspension. Some fine material could be transported on the order of tens or hundreds of meters, and traces of turbidity might be detected two to three miles or more from the construction site. The expected volume of sediment disturbed and the length of time required for resettling have not been estimated by the applicant.

4.571
Impacts on Water Quality Due to Pier Extension. Pier extensions would be associated with both Step I and Step II of plant construction and would require at least two lake working seasons. Expected impacts associated with the pier extension fall into two categories, alteration of flow patterns, and resuspension of sediment in the water column. The pier modifications would take place within the confines of the Conneaut Harbor breakwaters. Evidence from aerial photos, current measurements, sediment composition, and water quality analysis indicates that considerable mixing takes place within the

outer harbor area. Semi-permanent eddies are associated with openings in the breakwater, which are responsible for the deposition of fine grained materials at certain locations. The proposed Step II dock extension is located in one such area. The draft EIS discussed water quality effects resulting from construction of a pier extension, and new dock, both consisting of interconnected steel sheet pile cells. In response to comments received on the draft EIS, a new "open pier" design is proposed. This new design which occupies less bottom habitat and allows free circulation of water is discussed in this statement as the primary proposal. Water quality construction impacts which would have occurred as a result of the original proposal are discussed in the following paragraphs. Impacts associated with construction of the new design structure are also discussed. Dredging impacts on water quality are essentially the same for both proposals.

4.572
Step I Activities of the Original Proposal. The placement of interconnected steel pile cells was expected to create significant turbidity at a distance of several meters from the pile driving operation. Turbidity would be caused by accidental spillage of material used to fill the sheet pile cells. The fill material was not expected to be highly organic, but might contain chemicals that could be suspended or dissolved in the water column through leaching or spillage. Extension of the pier would alter flow patterns by effectively extending the confined mouth of Conneaut Creek into the harbor another 400 feet. The precise magnitude of this impact effect could not be quantified, but it was expected that the eddy between the existing pier and the eastern breakwater opening would be altered. In the eastern opening of the breakwater the current might be decreased which could potentially trap increased sediment deposition rates between the dock and the U.S. East Breakwater.

4.573
Step II Activities of the Original Proposal. Resuspension of sediments and turbidity associated with the pier construction would occur as projected above during Step I construction activities. However, dredging would be required to achieve a navigable water depth alongside the pier, and blasting through rock may be required. The sediments in the area to be dredged are primarily fine (0.125 mm) (refer to Table 4-297) and could remain suspended for an unquantified period of time. It is likely that eddies within the harbor would mix some of the resuspended sediment with harbor water and carry it beyond the harbor confines although a major portion of material would settle out of the water column very close to the dredging location. Neither the depth of accumulated fine sediments nor the extent of blasting necessary is known at present. The originally proposed 1,100-foot-long Step II pier extension would form a six-to eight-acre

Table 4- 297

Grain Size Analysis of Sediments in Conneaut Harbor
Near the Proposed New Pier Construction

(Numbers indicate percent dry weight.)
('LE2' and 'LE3' are sampling location codes.)

Grain Size (mm)	Sample of July 7, 1977 LE2	Sample of July 7, 1977 LE3	Sample of August 15 & 17, 1977 LE2	Sample of August 15 & 17, 1977 LE3
≥2.0	0.10	0.54	0.0	0.0
1.0	0.14	0.14	2.0	0.0
0.50	0.10	0.14	1.0	1.0
0.30	4.80	6.36	---	---
0.25	---	---	8.0	1.5
0.125	19.98	14.96	---	---
0.100	---	---	21.0	7.5
0.063	30.06	25.58	---	---
<0.063	44.82	52.28	---	---
0.050	---	---	23.0	25.0
0.002	---	---	42.5	62.5
<0.002	---	---	2.5	2.5

Source: Aquatic Ecology Associates, Second Interim Report, September 15, 1977.

Table .98
Sediment Chemistry in Lake Erie and Conneaut Harbor
(All values expressed **in parts per million**)

Stations LE1 and LE9 are outside the Conneaut Harbor at the 30 ft. contour; LE2 and LE3 are inside Conneaut Harbor near the site of the proposed pier construction. A single underline under a number indicates, according to EPA Region V criteria, moderate degree of pollution; a double underline indicates heavy pollution; see text for explanation. Does not hold for N-NO_2, N-NO_3 or TOC for which criteria are not available.

	Samples from 15 & 17 Aug 1977				Samples from 17 & 18 May 1977			
	Lake Erie		Conneaut Harbor		Lake Erie		Conneaut Harbor	
Parameter	LE1	LE9	LE2	LE3	LE1	LE9	LE2	LE3
NO_2-N	1	2	1	1	1	1	1	1
NO_3-N	4	5	4	5	2	1	3	2
NH_3-N	80	100	80	100	8	8	4	10
PO_4-P	170	200	240	110	10	10	10	10
TKN	550	1,400	780	780	1,700	20	50	500
Cd	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cr	9	17	14	12	44	22	25	22
Cu	14	26	25	26	29	4	8	16
Fe-Total	30,700	31,500	34,000	31,600	38,100	15,100	31,700	25,900
Ni	26	38	25	31	50	34	19	26
Pb	15	28	24	27	42	80	10	17
Zn	160	130	100	94	170	69	110	91
TOC	2,700	4,100	3,500	4,700	5,500	700	1400	3900
Oils	60	60	1,000	100	80	100	60	100
Hg	< 1	< 1	< 1	< 1	6	< 1	< 1	5

Source: Aquatic Ecology Associates, Second Interim Report, 15 September 1977

area of confined water with poor circulation between itself and the pier extended during Step I. The oscillatory flow at the eastern breakwater opening would probably be affected, but the size and direction of this effect cannot be predicted now. The dredging required alongside the new pier will have an adverse localized impact on harbor water quality. As the bottom materials are resuspended, increases in the concentrations of ammonia, mercury, copper, nickel, zinc, total Kjeldahl nitrogen, chromium, lead, and oil can be expected in the water column (refer to Table 4-298). The increased concentrations of these chemcal constituents would be expected to return to ambient levels within a few days. Harbor water quality is expected to return to ambient levels within several days after dredging operations cease. Some secondary chemical changes may be involved as well. Some of the sediments dredged may be in a reduced, or partially reduced state, especially if they were deep enough to be far removed from any significant oxygen concentrations. When the sediments are raised into the oxygen-rich waters of the harbor, chemical and biochemical oxidation reactions may take place. For example, free metals could form their oxides, and biochemical reactions could oxidize the organic matter present, thus consuming dissolved oxygen.

4.574
Step I Activities of the New "Open Pier" Proposal. Sediment resuspension and turbidity impacts will occur as discussed under Step I construction for the original proposal. The new proposal for pier extension will offset water circulation impacts caused by extending the mouth of Conneaut Creek further out into the harbor. However, some minor alteration of water currents within the harbor area will still occur.

4.575
Step II Activities of the New "Open Pier" Proposal. Sediment resuspension and turbidity effects caused by new pier construction will occur as discussed under the original proposal. The new "open" pier will allow free circulation of water between itself and the pier extension. Any current alterations produced by the new open pier will have negligible impacts on ice formation in Conneaut Harbor. Water quality impacts caused by dredging associated with the New Step II proposal will be essentially the same as those impacts discussed above under the original proposal.

4.576
Alternative pier alignments which would extend further out into deeper water might reduce the need for dredging in shallow water, but would interfere with the ability of large vessels to use the harbor as a turning basin. Also, the desired amount of dock space could not

be provided and greater impacts to Conneaut Harbor circulation patterns would result. The new dock and pier extension must be of the size proposed in order to accommodate 1,000-foot lake vessels and house the equipment necessary for loading and unloading activities.

Impacts of On-Site Construction

4.577
Effects of onsite construction include sediment loading associated with increased erosion, changes in water chemistry related to increased concentration and volume of runoff, and effects of spillage or leaching of fuel, oil, and other chemicals used on the construction site. Spill prevention containment and countermeasure plans would be required for any oil and fuel storage facilities approved on-site during construction

Impacts on Inland Waters

4.578
Impacts on inland waters are primarily related to construction activities, stormwater runoff, and culverting of Turkey Creek. All of the streams on and near the project site (including Conneaut Creek, Turkey Creek, Raccoon Creek, and a few small, unnamed tributaries to Lake Erie) would be affected by runoff due to construction activities.

4.579
During the review period for the draft EIS a number of comments were received opposing the applicant's original proposal to fill and divert Turkey Creek. In response to these concerns, the applicant decided to reject the original proposal and adopt a new plan which specifies that the upper tributaries and upper section of the main branch remain intact within a "greenbelt area" and that a portion of the lower section would be culverted. This eliminates the diversion ditch which was originally proposed, and alters the construction and operation phase impacts on water quality. For comparative purposes the impacts of both plans are addressed in this section.

Original Proposal

4.580
A worst case situation, in which the entire site is exposed during land clearing and grading operations and no erosion control measures were implemented, would have resulted in the addition of about 30,000 tons per year of total solids to Conneaut Creek and 90,000 tons per year to the diversion channel which eventually discharges into Conneaut Creek. The total (direct plus indirect) for Lake Erie would

be about 200,000 tons per year. These figures are based on a sediment loading rate of 150 tons/acre/year which is typically observed only for small construction sites in moderate or steep hills. Sediment loading rates of five tons/acre/year may be more reasonably expected from a large flat area such as the proposed site. Use of this rate results in an estimated worst case total of 6,500 tons per year without erosion control. The erosion control measures could reduce suspended solids by approximately 60 percent but little can be done to prevent the runoff of dissolved solids.

4.581
The impact on water quality in the diversion channel would have been severe with or without erosion control based on the 150 tons/acre/year figure, and the sediment-laden waters discharged from the channel to Conneaut Creek would have adversely affected the creek's lower reaches. The addition of nearly 120,000 tons per year is nearly double the normal load carried by Conneaut Creek. Sedimentation in Conneaut Harbor would subsequently be increased during the construction period. This could increase the frequency and amount of maintenance dredging needed to provide adequate harbor depth for commercial navigation. Should increased maintenance dredging be required, additional periodic water quality impacts would occur.

4.582
Utilizing the five tons/acre/year figure, the total sediment load would be 6,500 tons per year during the peak construction period without erosion control. Once protective measures are implemented the sediment load would be reduced to 2,600 tons per year. Based on these figures, sediment losses would not affect Conneaut Harbor maintenance and operation, or its usefulness as aquatic habitat. This expectation is based on the apparent continued successful utilization of the harbor during 1976-1978 when major construction activities associated with the expansion of the Pittsburgh and Conneaut Dock Company and Bessemer and Lake Erie Railroad facilities took place. These activities included clearing approximately 500 acres which drain into Conneaut Creek without any extraordinary erosion control requirements. The proposed U. S. Steel facility will impact a substantially smaller amount of the Conneaut Creek drainage area. Moreover since surface runoff from the proposed plant site must travel a long distance to reach Conneaut Creek, some of the sediment will settle out before it reaches the creek.

4.583
The dredging record for Conneaut Harbor indicates several things. First, the volume of dredged sediments varied widely from 28,000 to 575,00 cubic yards per year for 1973-78. For comparison, site runoff transporting the unsettled fraction of an estimated 2,600 tons per

year of sediment from the Lakefront Plant site during construction would be distributed among several water bodies. Second, the volume dredged during the 1976 to 1978 construction period was considerably below the six-year average. Consequently, significant increases in dredging requirements are not anticipated during the Lakefront Plant construction.

4.584
Based on information supplied by the applicant in Chapter One of this statement, exposed portions of the site will be reseeded or otherwise protected during construction to minimize erosion. Such control measures must meet the approval of the Commonwealth of Pennsylvania. Thus, it is not likely that the sediment loading rates projected under either worst case scenario would ever be achieved. However, despite controls, erosion would continue as long as land clearing operations proceeded at a far greater rate than the implementation of protective measures.

4.585
The original plans for Turkey Creek called for filling the main stem and all tributaries between Lake Erie and the new storm water interceptor channel to be constructed just north of the B & LE Railroad (see Figure 1-36). Approximately 33,000 feet of drained creekbed would be permanently filled. The diversion channel would have been about 16,000 feet long, 44 feet wide, and an average of six feet deep. To alleviate erosion, an energy dissipation system would be installed at the downstream end of the channel where it undergoes a sharp drop in elevation of 79-80 feet prior to entering Conneaut Creek. The bulk of the existing Turkey Creek drainage basin, about 90 percent or 7.3 square miles would drain into the new channel. Under the original proposal, the channel would also be used to drain storm water from the proposed plant although detailed plans were not provided by the applicant. The diversion of water from the undisturbed upgradient portions of the Turkey Creek watershed into a 16,000-foot drainage channel would have an adverse impact on quality of water that will eventually discharge into Conneaut Creek. For example, the water would undergo a rise in temperature of 1-2°C due to the lack of vegetation which would provide shade. Water would become stagnant in the first 14,000 feet of the channel due to the minimal change in gradient while erosion in the last 2,000 feet of the channel would increase due to a rapid drop in elevation as the channel approaches Conneaut Creek. These adverse changes in water quality would be further compounded by runoff from the developed areas of the plant site and the new Bessemer and Lake Erie Railroad yard.

4.586
The originally proposed diversion channel would also increase stream velocities in the undisturbed watershed upgradient causing increased erosion and sedimentation. In addition the improved drainage afforded by the diversion channel could cause smaller tributaries to remain dry over a larger period of time. Finally both the volume of runoff and the concentration of dissolved and suspended solids would be higher during and after storm events. The post-construction impacts are essentially those lingering from the construction phase. Suspended solids loads and associated siltation would remain elevated as finer materials are removed from the bed of the diversion channel. This scouring action would continue for a significant time period (several years) and would be most prevalent where the channel bottom is composed of clay or other fine-grained soils. Growth of new vegetation to the point that natural (summer) shading is returned would also take a significant amount of time so that elevated summer temperatures would also be a lingering effect. The bed of the diversion channel in certain sections could consist of material in its chemically-reduced state, since it was formerly a part of an oxygen-deficient environment. The exposure of this material to an oxidizing environment can result in certain chemical reactions. Another initial difference would include a reduction in dissolved organic matter that normally results from the decay of organic material.

4.587
The originally proposed new streambed would have had very little organic matter in it initially. Also, exposure of material that is in a chemically reduced state could have caused a temporary drop in the dissolved oxygen level of the water in the channel.

Current Proposal

4.588
Under this plan the applicant proposes to culvert Turkey Creek between State Line Road and a point approximately 460 meters (1,500 feet) upstream of Lake Erie. Approximately 7,500 feet of streambed would be altered to effect the installation of a culvert 5,600 feet in length. The difference of 1,900 feet accounts for the straightening of bends and meanders in the mainstem and tributaries of Turkey Creek affected by this proposal. A map showing the general location of the culvert along with a more detailed discussion of the plan is contained in Chapter One.

4.589
Installation of the culvert would be accomplished by clearing and grading the existing streambed, placing precast concrete pipe sections in the prepared channel and backfilling to project grade. Disturbance of the streambank and streambed during preparation for

culvert installation will lead to increased erosion and sedimentation. The effects of increased erosion and streambed disturbance will be high sediment loading to lower Turkey Creek and associated increases in dissolved and suspended solids. The impact on water quality in the lower reaches of Turkey Creek could be severe if the work is performed when flow is relatively low. Under low flow conditions, the added load would lead to high concentrations of total solids and subsequent sedimentation. Water quality impacts can be reduced by use of silt screens or gravel bedded silt catchment basins downstream of the construction area. After construction, the catchment basin gravel along with trapped sediment could be removed from the stream. Additionally, by starting construction at the upstream limit of the proposed culvert and by cutting through one meander at a time, the sediment could be trapped and removed prior to initiating work on the next meander. New sections which are cut in the dry between meanders could be compacted and bedded with gravel before being connected to the main flow of the creek. This would also reduce the amount of siltation. If upland vegetation is not cleared until after culverting is complete, the quantity of solids reaching the stream via erosion would be significantly less than a situation where vegetation was removed prior to culvert completion. The water quality impact of erosion and sedimentation could be greatly reduced if work were performed during periods when the stream is dry.

4.590
Certain sections of the newly cut bed may consist of materials that are in a chemically reduced state since it was formally part of an oxygen-deficient environment. The exposure of this material to an oxidizing environment can result in certain chemical reactions. This may also cause a temporary drop in the dissolved oxygen level of the water in the stream. The actual placement of the precast pipe and clean backfill should have minimal affects on Turkey Creek water quality. The introduction of sediment or oxygen-deficient materials from the altered section of the creek will cease after the culvert is in place. The upper sections of Turkey Creek will remain intact within a "greenbelt zone," thus, increases in water temperature and erosion which were anticipated to occur under the original plan due to vegetation removal, are not applicable to the current plan.

4.591
The Turkey Creek culvert will be installed prior to site development activities such as clearing, grubbing, grading, and filling to project grade. Thus, construction related runoff will not be able to enter the creek along this 5,600-foot stretch covered by culvert. The potential for construction runoff to enter Turkey Creek at points above and below the culvert does exist. In addition to Turkey Creek, all of the other streams on and near the project site (including Conneaut Creek, Raccoon Creek, and a few small, unnamed tributaries to Lake Erie) would be affected by runoff due to construction.

4.592
A worst case situation, in which the entire site is exposed during land clearing and grading operations and no erosion control measures were implemented, could result in the addition of about 6,500 tons per year of total solids distributed to Conneaut Creek, Turkey Creek, and Lake Erie. This figure is based on an estimate of five tons/acre/year sediment loading rate. Both Turkey Creek and Conneaut Creek eventually discharge their loading to Lake Erie. The applicant estimates that anticipated erosion control measures could reduce the loads of suspended solids by roughly 60 percent, but little can be done to prevent the runoff of dissolved solids.

4.593
Once protective measures are implemented, the total estimated sediment load would be reduced to 2,600 tons per year distributed between the three waterways. This quantity is not expected to affect the maintenance and operation of Conneaut Harbor or the usefulness of the receiving waters as an aquatic habitat. The applicant anticipates that the major portion of construction runoff will be discharged to Lake Erie. However, the impact on the water quality in the lower reaches of Turkey Creek below the culvert could be significant during periods of construction which coincide with low flow conditions in the culverted creek (July, September, October).

4.594
The applicant expects the impacts of construction on Raccoon Creek and Conneaut Creek to be insignificant. Diversion, relocation, or elimination would be required for some streams and small ponds on the project site. Three or four small (0.5-mile long) unnamed intermittent tributaries to Lake Erie (and several small ponds) would be eliminated by the grading and filling associated with site preparation. These streams have very small flows, are typically dry for several months each year, and are not considered to be of critical environmental importance.

4.595
Nonconstruction related water quality impacts associated with the current Turkey Creek proposal are discussed later in this chapter.

Surface Runoff -- Construction

4.596
<u>On-Site Impacts</u>. Detailed construction plans have not yet been developed and therefore it is not yet known exactly what portions of the lakefront site would drain into Lake Erie or Conneaut Creek. Under the current proposal, Turkey Creek would flow through a culvert for [illegible] feet with the majority of the construction area adjacent to the

culvert, and thus very little of its flow would enter the construction site in an exposed state. The applicant anticipates that the major portion of construction runoff will be discharged to Lake Erie; the Erosion Control Plan will identify the final discharge points.

4.597
The quality of the runoff from the site is expected to be altered. As a result of the anticipated accelerated erosion of the site during construction activities, the runoff will likely contain elevated levels of total and suspended solids. However, the actual concentrations of solids in the runoff will depend primarily on the erosion control measures utilized. The State of Ohio has no erosion control requirements, but the Commonwealth of Pennsylvania requires the development and implementation of an Erosion and Sedimentation Control Plan for permit approval. The applicant has indicated that it will implement the provisions of the applicable Pennsylvania Erosion Control Plan on all parts of the site, including those in Ohio. The quality of runoff from the proposed Lakefront Plant site will in large part depend on how closely the Erosion Control Plan is followed during construction activities.

4.598
The applicable erosion control regulations of the Commonwealth of Pennsylvania include the general requirement (Title 25, Rules and Regulations; Part I. Pennsylvania Department of Environmental Resources; Subpart C. Protection of Natural Resources; Article II. Water Resources; Chapter 102. Erosion Control) that "all earthmoving activities be conducted in such a way as to prevent accelerated erosion . . . design, implement and maintain erosion and sedimentation control measures which effectively prevent accelerated erosion . . ." The erosion control measures prepared by the earthmover to comply with the Pennsylvania law must be set forth in an erosion control plant prior to construction activities.

4.599
Since no plan has been developed at this time, specific details cannot be discussed. However, the applicant has indicated that the following erosion control actions will be taken, as required, on the Lakefront site:

- all runoff from the construction area will be collected and diverted to sedimentation basins for the removal of sediment;

- each sedimentation basin will have a capacity of no less than 7,000 cubic feet per acre of project area tributary to it; sedimentation basins must be able to pass a minimum flow of 2.0 cubic feet per second per acre of project area tributary to it. (Equivalent to the ability to contain a 1.9-inch rainfall and to the ability to pass water at a flow rate equivalent to a rainfall rate of two inches per hour.)

- buffer strips along waterways will be preserved or created where possible;

- efforts will be made to control erosion at its source as well as controlling sediment. The following erosion control actions will be adopted to stabilize newly disturbed areas.

. hydro-seeding;

. seeding with tall fescue.

- topsoil will be scraped from the construction site and stored on the site for approximately 1-1/2 to 2-1/2 years. A detailed discussion of various methods that could be used to stabilize the topsoil may be found in the Erosion and Sediment Control Guide for Erie County, published by the Erie County Conservation District (Erie, PA), in cooperation with the U. S. Soil Conservation Service (Erie, PA). The most applicable methods are outlined briefly below:

. Long-term Vegetative Cover on a Prepared Seedbed -- Topsoil pile is graded for controlled drainage, with furrows or diversions as needed. Fertilizer and lime are applied and the seedbed smoothed and firmed. Seed is applied by broadcasting, drilling, or hydraulic application and covered with 1/4-inch of soil.

. Long-term Vegetative Cover on an Unprepared Seedbed -- Same as above, except the seedbed is not smoothed and firmed. Mulch is also applied.

. Mulching -- Topsoil pile is graded for controlled drainage with furrows or diversions as needed. Plant residues or other suitable materials are applied to the surface of the soil. Typical materials include shredded or chopped cornstalks, hay, or straw. This mulch is anchored using netting or driven pegs;

- the site will be inspected at least four times a year by the Erie County Health Department to ensure conformance to the plan.

- other surface water control measures, as required.

4.600
During removal and storage of the topsoil, lower soil layers would be mixed to a certain extent, with the topmost layer. This mixing and handling could change the soil chemistry, porosity, and permeability, thereby affecting the soil reuse characteristics. During storage, the organic content of the soil in the interior of the pile might

decrease. Other chemical changes may also occur due to soil/water interactions. These changes are expected to be fairly minimal in terms of overall soil quality; however, it will probably be necessary to add fertilizers and lime to the soil when it is reapplied to the site and seeded.

4.601
The number and location of sedimentation basins has not yet been determined by the applicant nor has a detailed erosion control plan been developed. If the Erosion Control Plan is not followed, runoff from the Lakefront Plant site during the peak of construction activities is expected to contain solids loadings of approximately five tons of sediment per year per contributing acre. This would result in a total loading of approximately 6,500 tons of sediment per year from the site during peak construction. If topsoil is stored in unstabilized piles near the lake or if construction grading creates steep unprotected slopes the magnitude of solids loadings may be greater. If the erosion control plan is 60 percent effective for suspended solids removal, as estimated by the applicant, approximately two tons of sediment per contributing acre per year, or 2,600 tons per year will be added to runoff water during peak construction phases. In addition to sediment, runoff from the plant site may contain a number of chemical pollutants. The following pollutants may be generated from various operations and materials used throughout the various construction activities:

- Pesticides - *Insecticides, rodenticides and herbicides may* be used.

- Concrete - Wet concrete may be spilled at the concrete batch plant, during loading of trucks, in transport, and at the pouring sites. Cement used in the concrete-making process could be spilled or blown away by wind and subsequently exposed to rainfall. Wastewaters from washing out concrete trucks and other equipment will be highly concentrated. All of these activities could contaminate runoff and affect water quality.

- Fertilizers - Fertilizers might be used to promote vegetative growth on exposed soil surfaces with the goal of reducing erosion. The fertilizer would likely contain nitrogen, phosphorus and potash.

- Fuels and Lubricants - Diesel fuel oil, gasoline and lubricating oil are used by heavy construction equipment. If spilled or present on the exposed surface of equipment, these pollutants could contaminate the runoff.

- Other Organic Materials - Liquid chemicals are widely used for solvents surface treatment of walls, sealing cracks in

roofs and floor, gluing materials together, and in liquid and spray paints. Paints and organic solvents are on the proposed RCRA hazardous substance list.

- Biological Pollutants - The Biological contaminants with the greatest pollution potential are those of animal and human origin. Where improper sanitary conditions exist, runoff from a construction site may constitute a health hazard.

- Metals - Metal structures, construction vehicles, paints, pesticides, fungicides and construction chemicals are potential sources of heavy metals pollutants in runoff.

4.602
The extent to which these pollutants are exposed to removal by runoff will depend on construction practices. Poor construction practices that are likely to result in the unnecessary contamination of runoff include: dumping of excess chemicals and wash water into storm sewers or other drainage channels, disregard of proper handling procedures resulting in spills of construction chemicals, toleration of leaking storage containers or construction equipment, and improper sanitary conditions.

b) Impact on Water Levels

Construction Dewatering

4.603
Dewatering is often necessary to preserve the undistrubed bearing nature of soils during construction or excavation below the ground water level. After the required below-water level construction is completed, the excavation is backfilled and groundwater levels can be allowed to return to normal levels. No major dewatering operations are expected on the proposed site. The method of controlling water level depends primarily on the depth of excavation. At the Lakefront site the soils consist of glacial till which is sufficiently dense to allow seepage to be collected and pumped from sumps at the bottom of excavations. Lacustrine soils which are predominantly clayey may be treated similarly to glacial tills. However, lacustrine soils which are composed of mostly silt may require wellpoint dewatering systems. Strand deposits may also require either wellpoint or deepwell systems, with steel sheet pile cutoffs installed in some instances. Although dewatering activities will temporarily alter the groundwater flow system, the effects would be limited. Investigations indicate that there is no aquifer of any significance beneath the site and that recharge to receiving streams and Lake Erie is minimal.

Watershed Drainage

4.604
As part of the originally proposed project, portions of Turkey Creek would be filled. If the fill material were relatively impermeable, the Turkey Creek channel would no longer function as a drain, and the groundwater contours would no longer deflect in the area of the existing channel. Water levels could rise over the area currently influenced by the drain -- perhaps as much as 2.5 meters (8.2 ft) in the lower reaches. However, the current proposal calls for culverting the stream rather than filling and there would be little effect on groundwater levels especially if gravel bedding is used during culverting.

Shoreline Erosion

4.605
Although groundwater flow may be altered slightly during construction as a result of specific dewatering activities, effects at the bluffline would be minimal. The culverting of Turkey Creek should not result in a measurable elevation of the water table or additional seepage through the bluff. The maximum slope which the bluff could sustain might be decreased slightly. Overall, however, bluff recession rates are not expected to change significantly.

4.606
Offsite Impacts. Dust or other fugitive air emissions resulting from construction activities at the project site may be washed out of the atmosphere by rainfall or settle on the ground surface somewhere off the project site. Either of these phenomena could result in the degradation of runoff in areas outside of the Lakefront site. Since dust control will be practiced during construction activities, the overall impact of air emissions on runoff quality would likely be minimal. The construction of the access roads is also expected to affect the quality of runoff outside the project site. Drainage from the access road construction areas would likely impact the headwaters of Turkey and Raccoon Creeks, Conneaut Creek and a tributary of Conneaut Creek. The region near the headwaters of Turkey and Raccoon Creeks is extremely flat thus runoff will occur slowly which will limit the entrainment of sediment particles. Impacts on Conneaut Creek might be more severe as a result of the steeper terrain in this area.

Abnormal Events

4.607
The applicant has not addressed the possibility of the occurrence of abnormal events during construction. Such events could include

ruptures of fuel or chemical tanks, fires, vehicle accident, railroad car derailments, and events resulting from natural forces such as storms or flooding. The applicant has not shown plans for any specific preventive measures to minimize the possibility or effects of these events. The effects on Lake Erie or inland waters would depend on the nature, location, and quantity of material released to the environment and could have severe impacts, especially in localized areas.

Operations Impacts

4.608
The impacts on surface waters from the operation of the proposed plant would be primarily due to the discharge of various wastewaters and stormwater runoff. Process wastewaters (4,420 m^3/hr), cooling tower blowdown (approximately 6,680 m^3/hr), and roof runoff (up to 1,300 m^3hr*) would be discharged through a diffuser configuration some distance out on the bottom of Lake Erie. This is the flow expected as a consequence of the most intense rainfall (2.5 inches) to be expected in 24 hours in a two-year interval calculated by the applicants consultant. The dilution and movement of these effluents in Lake Erie have been modeled so that the expected concentration of various pollutants including temperature could be estimated. Runoff from raw material storage piles, solid wastes disposal facilities and other open plant areas would be directed mostly to Lake Erie.

Impacts on Lake Erie

Identification and Quantification of Contaminants to be Discharged

4.609
Process-Related Discharges. The major process facilities at the proposed plant are the coke plant, sinter plant, blast furnace, steelmaking units, continuous caster, hot strip mill, and plate mill. The principal contaminants (and those for which the EPA has set effluent guidelines) are as follows: suspended solids, oil and grease, ammonia, cyanide (A), phenols, sulfide, fluoride, and pH. These processes would also generate waste in the following categories:

- Heat - the release of waste heat will increase the temperature of the discharge water;

- Dissolved inorganic material - will cause an increase in specific conductance and total dissolved solids levels;

- Dissolved organic material - leading to increased values in tests for biochemical oxygen demand (BOD), chemical oxygen demand (COD), and total organic carbon (TOC); and,

- Heavy metals - principally iron, manganese, and tin and, to a lesser extent, lead chromium, arsenic, antimony, cadmium, and zinc.

While these parameters are not covered by EPA guidelines, many of them are covered by water quality standards for the State of Ohio (in which the discharge would be located).

Chemical Discharges

4.610
The applicant's estimate of projected net loads of "effluent guideline" parameters in the main effluent from the proposed plant is presented in Table 4-299. Three sets of numbers are reported representing "annual average," 30-day average, and daily maximum loads. National Pollution Discharge Elimination System (NPDES) permits are generally based on the 30-day average loads. The "annual average" loads are, as explained in the table, a conservative estimate of what may be projected for actual annual averages. The effluent loads and concentrations to be expected in the main wastewater discharge to Lake Erie for a large number of parameters is shown in Table 4-300. The applicant expects that, with one exception, the total load for all guideline parameters (i.e., considering the plant as a whole) would be in compliance with guideline values set by the EPA. The one exception is for ammonia, which is expected to exceed these guidelines. Table 4-300 specifies the contributions of Lake Erie and the proposed plant in the total load expected in the effluent. Lake Erie contributes to the total load since lake water used by the plant, may exhibit high ambient concentrations for certain chemical constituents. The additive effects of the Lake Erie load are somewhat magnified by the proposed plant due to a concentration effect associated with the operation of cooling towers. The reported levels of Lake Erie are shown in Column Two of Table 4-300. In the determination of Lake Erie baseline conditions, the following sources have been used: recent sampling by Aquatic Ecology Associates at the proposed site; public water intake analyses from Erie, Conneaut and Ashtabula; STORET data; other published data including the CLEAR survey of 1973-1975, International Lake Erie Water Pollution Board report of 1969, and the Lake Erie Environmental Summary, 1963-1964 of the FWPCA. These sources have been weighted as to local, up-to-date validity in roughly the order listed. In cases where Lake Erie concentrations were always below analytical detection limits, an estimate was made with the best available data; the parameters for which such estimates were made are identified in Table 4-300.

4.611
The calculation of the net loads to be expected for guideline parameters (excluding pH) is based on the following information and/or assumptions:

- That the loads from the steelmaking processes, expressed as pounds per ton of product, are as given in the letter of 5 August 1977 from the Regional Administrator, EPA Region V to the U.S. Steel Corporation, with the following exceptions: (A copy of this letter is appended in this statement.)
    1) The loading of ammonia from the coke plant is that estimated by U.S. Steel Corporation rather than the EPA guideline number (this value exceeds the guideline number).
    2) All loading factors given by the EPA for the coke plant were multiplied by 1.95. This results from a 25 percent allowance for facilities equipped with COG desulfurization and a 70 percent allowance for facilities using an indirect ammonia recovery process.
- That there is an additional net load of suspended solids from nonsteelmaking portions of the plant including the central shops and offices, the sanitary wastewater system, the miscellaneous service water, and the blowdown from the indirect cooling water systems. The applicant's consultant estimates that these sources add a net loading of 451 kilograms per day, (35 percent of total net load) in the "annual average" case and 869 kilograms per day (24 percent of total net load) in the "daily maximum" case.
- That there are no loads due to a scarfing operation. Guideline numbers for this operation are included in the EPA letter, but no production or water-use data for the proposed plant have been broken out for this operation.
- That the production rates for the various processes, both daily average and daily maximum, are the same as those supplied by the U.S. Steel Corporation to Arthur D. Little, Inc.
- That the water use factors (expressed as gallons per ton) are those estimated by U. S. Steel Corporation.
- That the volume of blowdown from the indirect cooling systems is constant, i.e., does not vary with the production rate.

4.612
The effluent concentrations given in column number three of Table 4-300 show "typical" and "high" numbers. The typical numbers represent a maximum for a 30-day average, according to the EPA guidelines: (For suspended solids, the contribution for non-steelmaking processes would be subtracted for any guideline comparison). Data used in the

Table 4- 299

Projected Net Loads of Guideline Parameters
In the Lakefront Plant Effluent

Parameter	Net Loads: "Annual Average"(1) (kg/d)	Net Loads: 30-Day Average(2) (kg/d)	Net Loads: Daily Maximum(3) (kg/d)
Ammonia	226	238	714
Cyanide (A)(4)	4.2	4.47	13.6
Fluoride	342	389	1170
Oil and Grease	308	370	1110
Phenols	8.35	8.94	26.8
Sulfide	6.1	6.67	19.5
Suspended Solids(5)	1260	1370	3630

(1) Derived from average annual production rates and EPA guidelines for 30-day average. Since this 30-day average is the maximum allowed in this time period, actual averages would be somewhat lower. Thus, these projected net loads are conservative.
(2) Derived from maximum production rates and EPA guidelines for 30-day average.
(3) Derived from maximum production rates and EPA guidelines for maximum daily discharge
(4) Cyanide that is amenable to chlorination.
(5) Includes 451 kg/d from processes or wastewaters not covered by guideline parameters.

Source: United States Steel Corporation.

calculation assumed annual average production rates at the proposed plant, net loads (for guideline parameters) in compliance with the EPA's 30-day (maximum) average, (except ammonia) and typical background levels of the pollutants in Lake Erie. The high numbers represent a worst-case situation, in that they are based on a combination of high background levels in the Lake; maximum daily production rates for all processes at the proposed plant; and the maximum discharge allowed by the EPA for any one day in a month.

4.613
The frequency of occurrence expected under worst-case conditions cannot be accurately predicted, however, for purposes of this analysis, the applicant's consultant estimates that the worst case condition will occur once per year. These effluent concentrations must also be taken as dry-weather flows. Additional loads (and, thus, different concentrations) would be present in wet weather since the applicant plans to add to discharge roof runoff through the main plant outfall pipe. The effluent concentrations expected for non-guideline parameters including pH were estimated by comparison with other steel industry effluents. NPDES data on the applicant's Fairfield (Alabama) plant were obtained, in the form of "discharge monitoring reports" for the months of February, March, and April in both 1976 and 1977. This is self-monitoring data submitted to the appropriate regulatory authorities in connection with the National Pollution Discharge Elimination System (NPDES) permit requirements (PL 92-500). These data included monthly averages, minimums and maximums for most of the parameters listed in Table 4-300. Values reported for flow, temperature, specific conductance, pH, and dissolved oxygen are those for the actual effluent while all other values on the monthly reports are in net pounds per day of the specified pollutant.

4.614
For each parameter of interest (except zinc, total cyanide, copper, and mercury), an average of the six monthly averages was calculated. Net loadings to be expected at the proposed Lakefront Plant were then calculated on the basis of the following assumptions:

- The net loadings in terms of pounds/day per ton of steel made, for each parameter are the same for both the Lakefront and Fairfield Plants;
- The proposed Lakefront Plant will produce 20,500 tons of steel per day.
- The values for the parameters for which actual values were available (temperature, pH, specific conductance, dissolved oxygen) would be the same for both plants.
- For zinc, cadmium, copper, and mercury a net load was estimated by the applicant based on data from the sampling of different process effluents at the Fairfield Plant.
- For total cyanide, the applicant estimated a net load based

Table 4- 300

Projected Characteristics of Main Wastewater Discharge from the Proposed Plant

Parameter	1 Net Load from Proposed Plant: Annual Average (kg/day)	1 Net Load from Proposed Plant: Daily Maximum (kg/day)	2 Concentrations in Intake (Lake Erie) Water: Typical (mg/l)(2)	2 Concentrations in Intake (Lake Erie) Water: High (mg/l)(2)	3 Resulting Effluent Concentration: Typical (mg/l)(2)	3 Resulting Effluent Concentration: Worst (mg/l)(2)
Flow, m^3/hr	N/P(1)	N/P	N/P	N/P	10,350(3)	11,086(3)
Temperature, ^oC						
Summer:	N/P	N/P	23	N/P	25	33
Winter:	N/P	N/P	1	N/P	7	20
Ammonia (Total)	226	714	0.04	0.3	0.96	3.1
Arsenic (Total)	0.40	0.80	0.001(4)	0.005(4)	0.0030	0.0097
BOD_5	836	1920	1.7	3.0	5.7	11.
Cadmium (Total)	0.01	0.02	0.001	0.005	0.0014	0.0066
Chromium (Total)	4.54	13.6	0.005	0.010	0.025	0.0[illegible]
COD	8240	34000	10	25	47	160
Copper (Total)	0.0	0.0	0.001	0.005	0.0014	0.0066
Cyanide (Total)	32.8	100.	0.0004(4)	0.0008(4)	0.13	0.38
Cyanide (A)	4.2	13.6	0.0002(4)	0.0005(4)	0.017	0.052
Dissolved Oxygen	N/P	N/P	11	15 (low 7)	6.6	8.0 (low 4.5)

Table 4-30 0 (Continued)

	1		2		3	
	Net Load from Proposed Plant		Concentrations in Intake (Lake Erie) Water		Resulting Effluent Concentration	
Parameter	Annual Average (kg/day)	Daily Maximum (kg/day)	Typical (mg/1)(2)	High (mg/1)(2)	Typical (mg/1)(2)	Worst (mg/1)(2)
Fluoride	342	1170	0.13	0.20	1.6	4.7
Iron (Dissolved)	164	458	0.05	0.1	0.73	1.9
Lead (Total)	9.07	18.1	0.005	0.01	0.044	0.082
Manganese (Total)	46.3	90.7	0.01	0.02	0.20	0.37
Mercury (Total)	0.0	0.0	0.0001	0.0003	0.00014	0.0004
Oil and Grease	308	1110	1	5	2.6	10.8
pH, Standard Units	N/P	N/P	7.8	8.3 (low 7.0)	7.3	8.3 (low 6.0)
Phenols	8.35	26.8	0.0006	0.003	0.034	0.10
Specific Conductance, μ mhos	N/P	N/P	300	600?	700	900
Sulfide	6.1	19.5	0.002	0.010	0.027	0.087
Total Dissolved Solids	78200	141000	200	250	590	860
Total Suspended Solids	1260	3630	10	20	19.	40.
Zinc	1	2	0.020	0.070	0.031	0.10

Table 4-300 (Continued)

(1) NP = Not Pertinent.
(2) Unless otherwise specified with parameter name.
(3) These are dry weather flows. Runoff from roofed areas is projected to add approximately 1300 m^3/hr to discharge from a 2.5 in., 24-hour storm.
(4) These concentrations are estimates, since background levels are below detection limits.

Source: Arthur D. Little, Inc. estimates and United States Steel Corporation.

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on (treated) coke plant effluent data from the Fairfield Plant and pilot plant data on the treatability of blast furnace wastewaters by alkaline chlorination.

The net loadings calculated are shown in Table 4-300, column number one.

4.615
The procedure outlined above thus assumes equal loadings (per ton of steel produced) for all parameters except temperature, specific conductance, pH, dissolved oxygen, total cyanide, copper, mercury and zinc. However, it does not assume that water use (per ton of steel) is the same as both plants. The water use at Fairfield is about 2,860 gallons per ton while that expected at the Lakefront plant is 3,430 gallons per ton. This comparison is further distorted by the fact that some runoff may be included in the flow used for the Fairfield effluents. The "high' values listed for the net effluent loadings (on non-guideline parameters) in column number one of Table 4-300 are rough estimates based on the ratio of "maximum" to "average" values given in monthly NPDES discharge monitoring reports.

4.616
The correlation between the Fairfield Plant and the proposed plant may not be very good. In some instances, the proposed plant would have more advanced treatment than exists at Fairfield (e.g., blast furnace wastewaters) so that the estimates given for some parameters in Table 4-300 may be high. Second, only a limited amount of data from the Fairfield plant were available for use, and these may not be representative of long-term operations. Third, the background loadings of several contaminants in Lake Erie are uncertain and for some other parameters, there are little data available. (In cases where Lake Erie concentrations for a pollutant were below analytical detection limits (e.g., for cyanide, and arsenic) an estimate was made using the best available data.) Fourth, the Lake Erie loadings in the intake water may be altered such that lesser amounts appear in the effluent. For example, Lake Erie water that eventually (after use in a process) goes through a treatment system may be reduced in one or more constituents. The concentrations of three other pollutants in the proposed discharge namely sulfates, residual chlorine, and chlorophenols have also been estimated. There is a high degree of uncertainty in each of these estimates so that only one significant figure is given. For each of the following pollutants the applicant's consultant has reported the estimated concentration and applicable standard along with a brief summary of the rationale used to develop these estimates.

Sulfates

4.617

- Typical effluent concentration 40 mg/l
- Worst case concentration 60 mg/l
- Assumed typical Lake Erie concentration was 25 mg/l (high 30 mg/l)
- Ohio EPA standard is 250 mg/l for public water supplies
- Rationale:
  - (1) Blowdown from indirect cooling systems (6,680 m^3/hr) will have 40 mg/l sulfate; increase is due mostly to concentration effect; very little is due to scrubbing of SO_2 from air.
  - (2) Process blowdown from gas cleaning operations (in coke plant, sinter plant, blast furnace, and steelmaking) (1,230 m^3/hr) will have 100 mg/l sulfate due to background levels in Lake Erie water (25 percent) and scrubbing of SO2 (75 percent).
  - (3) Other processes (3,190 m^3/hr) will have 30 mg/l sulfate; includes some pickup due to SO_2 scrubbing.

Residual Chlorine

4.618

- Typical effluent concentration 1-2 ug/l
- Worst case concentration 4 ug/l
- EPA criterion is 2 ug/l for salmonid fish and 10 ug/l for other fresh water and marine organisms.
- Rationale:
  - (1) Assumed excess chlorine added in alkaline chlorination unit treating blast furnace wastewaters so that residual chlorine was 1 mg/l. Further assumed that the activated carbon treatment that follows would remove 90 percent-95 percent of this chlorine yielding a (treated) process wastewater with 50-100 ug/l.
  - (2) Assumed residual chlorine in effluent from domestic wastewater treatment plant was 0.1 mg/l.
  - (3) Contribution from use of Lake Erie water is assumed to be negligible. All Aquatic Ecology Associates 1977 sampling results at the proposed site show residual chlorine to be below the 0.1 mg/l detection limit.

(4) With appropriate dilution factors for these two streams (after mixing with other wastewaters from the plant), the combined effluent is calculated to contain 2-4 ug/l of residual chlorine.
(5) One half of this residual chlorine is expected to be used up before discharge (by reaction with other substances in the water).

Chlorophenols

4.619

- Typical effluent concentration 2 ug/l
- Worst case concentration on the order of 4 ug/l
- EPA criterion for phenols (1 ug/l) is based upon data indicating fish flesh tainting and water supply odor problems when chlorophenols are in the 1 g/l (or above) range.
- Rationale:
  (1) Most chlorophenols will come from blast furnace wastewaters which may contain 4 mg/l phenols in untreated stream. (4-29)
  (2) Assume alkaline chlorination unit chlorinates all of the phenols resulting in 5.5 mg/l of chlorophenols.
  (3) Assume activated carbon removes 99 percent of these chlorophenols (which have a high affinity for carbon) resulting in 0.055 mg/l of chlorophenols in treated blast furnace wastewaters.
  (4) Dilution with other plant wastewaters reduces concentration in final effluent to 2 ug/l.
  (5) Production of chlorophenols in other wastewaters at the plant (e.g., domestic wastewaters which are chlorinated, or mixed wastewaters which will contain very small amounts of phenols and residual chlorine) will be negligible.

Priority Pollutants

4.620
As a result of a civil action brought against the EPA by various environmental groups, the EPA acceded to a consent agreement in June, 1976. This agreement binds the EPA to regulate or restrict point sources of discharges of certain chemicals, called priority pollutants, if warranted after investigations. These investigations which include determining the sources, ambient existence, and adverse effects of the priority pollutants, are being conducted currently. To date only that portion of the investigations pertaining to the

sources has been completed. Under these circumstances it is impossible to predict whether or not the proposed Lakefront waste treatment plant will achieve as yet undetermined future limitations and restrictions for priority pollutants. However, from that portion of completed investigations, the EPA has determined the priority pollutants that may be "present" in wastewaters from a steel mill. The resulting data have been reviewed by the applicant, the priority pollutants that were identified in process effluents corresponding to processes that are expected at the proposed plant are listed in Table 4-301. In many cases, current discussions of these chemicals have taken on a speculative nature because of the lack of information about their presence or absence in industrial effluents, their ambient concentrations, and their effects on the environment. For example, the concentration in an effluent required to designate a pollutant as "present" or "absent" is not clearly defined. If the cut-off level for a designation of "present" was set at 1 part per billion (ppb), then only one organic chemical (phenol) and a few inorganic chemicals (e.g., cyanide, arsenic, lead, zinc, chromium, antimony) would probably be included on the list for the proposed plant.

4.621
If "any concentration" were the criteria for designation as "present" (due to steelmaking operation and not to background occurrence) then the list given in Table 4-302 is considered a reasonable one for those priority pollutants that may be present. The list is broken down into three groups, nonchlorinated organics, chlorinated organics, and inorganics. The non-chlorinated organics are listed in rough order of their expected concentrations, with the highest listed first. The inorganics are listed in order of expected net loads (given in column number one of Table 4-300). The chlorinated organics are not listed in any particular order. The order expected among the three groups, based on concentrations, is inorganics, nonchlorinated organics, and chlorinated organics. The expected concentrations for the nonchlorinated organics are difficult to estimate. Phenol is likely to be present in the largest concentration due to the nature of the chemical and the coke plant operations (the major source of the non-chlorinated organic priority pollutants). As indicated in Table 4-300, the average concentration of phenols in the combined effluent is expected to average 0.034 mg/l. (The contribution of a Lake Erie loading to this concentration is small). This value represents the total concentration of all phenolic chemicals, i.e., all chemicals which have a hydroxyl group attached to an aromatic ring. There would likely be hundreds of such compounds of which phenol is only one. One review of phenolics from coal carbonization lists nearly 200 such compounds. (4-30) That report indicates that the greatest portion of phenols found in the liquid products of coal carbonization consist of the isomers of monohydric anddihydric phenols of the C_8 group, the isomers of monohydric phenols of the

Table 4- 301

Priority Pollutants That May Be Present in Proposed Lakefront Plant

Likely To Be Present	Presence Is Somewhat Speculative[1]
Benzene	Tetrachloroethane
Toluene	Chloroform
Phenol[3]	Selenium
Cyanide[3]	Silver
Naphthalene	Thallium
Arsenic	Dioctylphthalate[2]
Antimony	
Cadmium	
Chromium	
Lead	
Nickel	
Zinc	

(1) Recent analyses have indicated the presence of these materials. Detectability may be dependent wholly on background concentrations.

(2) Believed due to error related to sampling.

(3) These parameters were included in proposed effluent guidelines by the EPA in 1974.

Source: United States Steel Corporation (based on steel industry effluent analyses conducted by the United States Environmental Protection Agency).

Table 4- 302

Priority Pollutants That May be Present in
Wastewaters from a Steel Mill

Organics (Not Chlorinated)[1]	Organics (Chlorinated)
Phenol[3][4]	Chlorinated benzenes [3]
Benzene[3]	Chlorinated ethanes [7]
Toluene[3]	Chlorinated naphthalene
Ethylbenzene	Chlorinated phenols [2]
Dimethyl phenol	Chloroform
Dinitrotoluene	2-Chlorophenol
Naphthalene[3]	Dichlorobenzenes [3]
Fluoranthene	2,4-Dichlorophenol
Polynuclear aromatic hydrocarbons [13]	Dichloropropane [2]
	Halomethanes [8]
	Pentachlorophenol
	Tetrachloroethylene
	Trichloroethylene

Inorganic[2]

Lead[3]
Chromium[3]
Cyanide[3][4]
Zinc[3]
Antimony[3]
Arsenic[3]
Cadmium[3]

(1) Listed in order of expected concentration, highest first.

(2) Listed in order of expected net loads, highest first.

(3) Chemicals that have been found in effluents from processes similar to those expected at the proposed plant

(4) These parameters were included in proposed EPA effluent guidelines in 1974.

Note: Chemicals listed as given in the original list associated with the EPA Settlement Agreement. Numbers in brackets after a chemical classification indicate the number of specific chemicals in that class that were subsequently specified by the USEPA.

Source: Arthur D. Little, Inc. estimates.

Table 4-302 (Continued)

***Chlorinated benezenes**

chlorobenezene
1,2,4-trichlorobenzene
hexachlorobenzene

***Chlorinated ethanes**

1,2-dichloroethane
1,1,1-trichloroethane
hexachloroethane
1,1-dichloroethane
1,1,2-trichloroethane
1,1,2,2-tetrachloroethane
chloroethane

***Chlorinated naphthalene**

2-chloronaphthalene

***Chlorinated phenols**

2,4,6-trichlorophenol
parachlorometa cresol

***Dichlorobenzenes**

1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene

***Dichloropropane and dichloropropene**

1,2-dichloropropane
1,2-dichloropropylene (1,3-dichloropropene)

***Halomethanes**

methylene chloride (dichloromethane)
methyl chloride (chloromethane)
methyl bromide (bromomethane)
bromoform (tribromomethane)
dichlorobromomethane
trichlorofluoromethane
dichlorodifluoromethane
chlorodibromomethane

***Polynuclear aromatic hydracarbons**

benzo(a)anthracene (1,2-benzanthracene)
benzo (a) pyrene (3,4-benzopyrene)
3,4-benzofluoranthene
benzo(k)fluoranthane (11,12-benzofluoranthene)
chrysene
acenaphthylene
anthracene
benzo(ghi)perylene (1,12-benzoperylene)
fluroene
phenathrene
dibenzo (a,h)anthracene (1,2,5,6-dibenzanthracene)
indeno (1,2,3-cd)pyrene (2,3-o-phenylenepyrene)
pyrene

---

*Specific compounds and chemical classes as listed in the consent degree from NRDC et al versus Train.

C_9-C_{10} group, and the isomers of indanols of group C_{10}. Thus it is possible, that phenol is a minor constituent in the phenolics expected in the proposed plant's effluent and may not be present above 1 ppb.

4.622
Based on available effluent data, it is reasonable to assume that the other non-chlorinated organic priority pollutants will be lower in concentration than phenol. Thus, they would only be present below 1 ppb and would likely be below 1 ppt for those near the bottom of the list in Table 4-302. Generally low levels of organic chemicals, including polynuclear aromatic hydrocarbons (PAH) have been found in at least one set of analyses of steel mill wastewaters. (4-31) This work performed by the U.S. EPA concluded that: "Small amounts (1 ppm) of polynuclear aromatic hydrocarbons (PAH) may have been present in the coke (plant) sewer sample." However, PAH were found in sediment samples taken from the receiving stream. These PAH represented an envelope of polynuclears of increasing ring complexity from phenathrene and anthracene (molecular weight 178) through two dibenzanthracenes anthracenes (molecular weight 278). Typical concentrations of individual chemicals were in the range of 0.1-5 mg/kg (dry sample weight). The highest concentrations of PAH, up to 20-30 mg/kg (dry weight), were found in sediment samples taken just downstream (ca. 500 feet) from the coke plant outfall. (4-31) Since the proposed Lakefront plant wastewater treatment system is expected to remove more of the PAH than was removed in previous years at this EPA study site, the resultant sediment concentrations near the Lakefront plant outfall are expected to be less than those measured.

4.623
A review of literature on PAH in the water environment by Andelman and Suess includes one reference to a measured concentration of 12-16 ppb of 3,4-benzepyrene in the effluent from a coke byproducts plant after biological treatment. (4-32) This plant is presumably in the USSR, since the original reference is from the Russian Literature. The ratio of coke plant wastwater flow to total plant discharge at the proposed plant is 0.0228 so that if the proposed coke plant had a similar concentration of 3,4-benzepyrene in its effluent, the dilution factor would reduce this to about 0.3 ppb in the final effluent. It is likely that the concentrations of any (plant-generated) chlorinated organics in the effluent would be extremely small, well below 1 ppb for specific chemical. However, the total concentration of one class of chemicals, chlorophenols, might be around 2 ppb in the effluent. The only sources of free chlorine in the mixed effluent are the blast furnace (where alkaline chlorination would be used) and the sanitary wastewater (which would be chlorinated). The coke plant wastewaters would not be chlorinated. The possibility of a variety of parameters including some priority pollutants entering the

wastewaters due to air scrubbing in cooling towers cannot be eliminated. In the event that any priority pollutants are discovered in the net loadings from the proposed Lakefront plant in quantities or concentrations deemed harmful by the U. S. EPA, the applicant is committed to reduce those loadings to acceptable levels.

Fate of Chemicals Discharges into Lake Erie

4.624
Chemicals discharged into Lake Erie from the proposed plant may affect water quality in several ways. They may be absorbed onto soil particles or suspended solids and remain in the exosystem for a considerable length of time. This is especially true of organic chemicals and heavy metals. Some of those suspended solids may settle out in the proximity of the outfall. The applicant has calculated sediment buildup of 1-2 cm/yr in a radius of 100 meters from the outfall. The amount of sediment involved was estimated to be 480,000 kg/yr. Some organic chemicals may undergo photo-chemical reaction to form new compounds. Those reactions would be most prevalent on clear days when the sun is near its zenith. The applicant expects that essentially all of the organic compounds released will be biodegradable, though ates would vary widely and a variety of intermediate products would be formed. As stated earlier, discharge of ammonia would probably exceed EPA guidelines. The EPA criterion is 0.02 mg/l as un-ionized ammonia. The applicant expects an average effluent concentration of 0.96 mg/l and a worst-case concentration of 3.1 mg/l. The percentage of total ammonia that exists in un-ionized form increases with both temperature and pH.

Organic Chemicals

4.625
Types of Organic Chemicals Present. There can be a variety of chemicals in the wastewater discharge from the proposed Lakefront Plant. Three basically different types of organic chemicals are involved. First are the cyclic and polycyclic aromatic compounds derived from coal. Different representatives of these groups have been reported in different coke plant wastewaters. Only some members of the benzene family and naphthalene have been definitely identified in these waste streams in the United States. Many of these compounds are pure hydrocarbons but a variety of phenolics and other chemical classes are also expected. Chlorinated species may be formed if these wastewaters are mixed with other wastewaters that have been chlorinated, but this type of reaction is considered unlikely. The secold class of organic compounds is the linear, and branched chain, hydrocarbons. Some low molecular weight chemicals in this class can be derived from coal and, thus, may be present in the coke and sinter plant effluents. The greater fractions of chemicals in this class are more likely to be derived from the variety of lubricants,

hydraulic fluids, fuel oils, detergents, etc., used at the plant; these are long chain hydrocarbons, basically petroleum derivatives. The number of carbon atoms in these molecules can range from about 6 to 26. Those most likely to predominate would contain about 12 to 22 carbon atoms. The degree of unsaturation in these chemicals is variable. Except for a few specialty chemicals (e.g., some detergents) these chemicals would be pure hydrocarbons. The formation of chlorinated species, as discussed above, is considered unlikely. The third class is associated with biological growth and decay. This type would consist of a large variety of natural, or semi-natural (e.g., degradation products of synthetic chemicals), chemicals. They would appear in the coke plant treated effluent (biological treatment will be used), the cooling tower blowdown (from biological growth in the towers), and the plant domestic sewage treatment facility (which would include final chlorination). The specific chemicals in domestic sewage effluents have been studied and several compound lists are available. (4-33, 34, 35) Many of these chemicals are in the form of alcohols, sugars, organic acids, and amines. The hydrophylic nature of these substituted hydrocarbons makes them relatively soluble in water compared to the first two classes of organic compounds.

4.626

Initial Effects. In the discharge, a significant fraction of the organic material would be associated with the suspended solids which would consist of both organic and inorganic matter. This is especially true for the chemicals with low water solubilities (hydrophobic chemicals). As the discharge enters the lake, two processes would have an initial impact on the fate of some parameters. First, the heavier suspended solids would tend to settle out on the lake bottom. The largest deposits would be in areas not affected by the turbulence of the discharge. Although the actual percentage of total suspended solids settling near the outfall is not known, it may be calculated on a theortical estimate the potential for buildup of sediments. Calculations performed by the applicant indicates that sediment build-up on the order of one to two centimeters per year is possible in the vicinity of the outfall. However, most wastewaters would have gone through some form of gravity settling and/or filtration prior to discharge; which would tend to eliminate most of the denser particulates. The lighter particulates that are in the discharge may be relatively easy to resuspend, in periods when lake currents are moderate to high so that this estimate probably represents the maximum degree of buildup expected. The second process that would have an initial impact is cooling. As the warm discharge enters and mixes with the cooler lake waters, cooling (of the discharge) takes place. This change in temperature alters the water solubilities of organic chemicals, their tendency to adsorb on

Table 4- 303

Solubilities of Selected Organic Chemicals at Two Temperatures(1)

	Cool Water (mg/l)	Warm Water (mg/l)
Ethane	78 (15°C)	37 (40°C)
Butane	30 (15°C)	21 (38°C)
Butadiene	1,600 (15°C)	750 (38°C)
Benzene	1,800 (25°C)	3,900 (90°C)
Phenolics	67,000 (15°C)	infinite (66°C)

(1) The list of chemicals given here is for example purposes only (see text). There is no implication intended as to the presence or absence of these chemicals in the effluent.

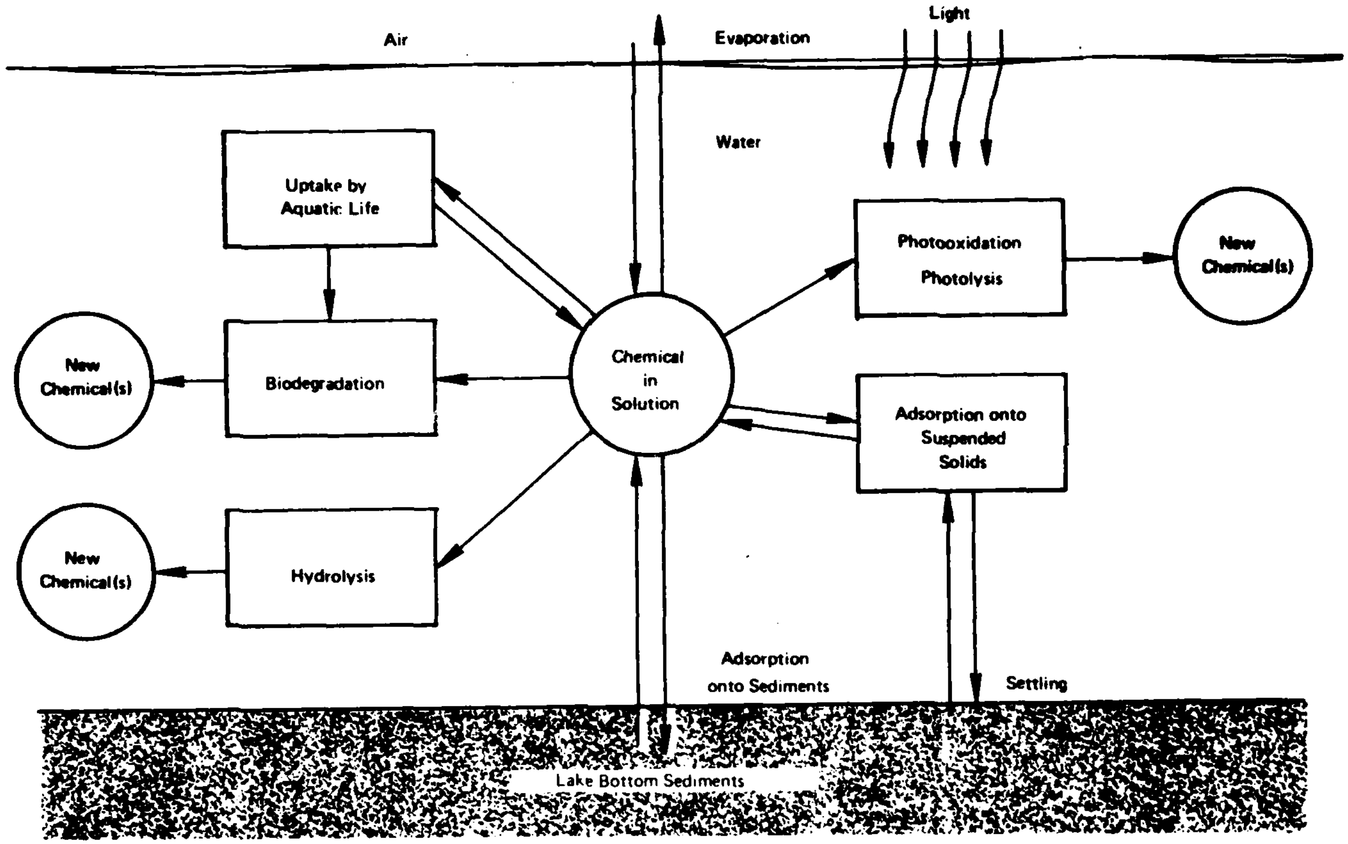
Source: Manual on Disposal of Refinery Waters, volume on Liquid Wastes, American Petroleum Institute, Washington, D.C., 1969.

solids, and other properties. In general, lowering of the water temperature will increase the solubility of low molecular weight volatile hydrocarbons and decrease the solubility of most other types of hydrocarbons. A few examples are presented in Table 4-303. The most significant effect on the fate of organic chemicals due to cooling will probably be an increased tendency for the higher molecular weight, low volatility species (i.e., those for which solubility is reduced) to associate with suspended solids. This association, or adsorption, would be with both the solids that were in the plant discharge and the background suspended solids present in the lake. A preference for adsorption onto the natural suspended solids of the lake is likely since they contain a high percentage of organic matter. The octanol/water partition coefficient can be used to measure the potential of certain for soil adsorption and bioaccumulation. The degree of association of organic chemicals with suspended solids of various organic content may be roughly estimated as noted below.

Long-Term Effects

4.627
The long-term fate of discharged organic chemicals will depend on a variety of processes including evaporation, adsorption, biodegradation, hydrolysis, photooxidation, and photolysis. These processes will have varying impacts on the fate of a chemical, depending on its physical and chemical properties, and on the environmental conditions. The more important environmental parameters include water temperature, pH, oxygen level, suspended solids content, light penetration, presence of microbial life, and presence of other chemical species that may serve to aid, or hinder any of the processes. The action of some of tese processes is shown schematically in Figure 4-78. Note that only such processes as biodegradation, hydrolysis, and photo-oxidation change the structure of the chemical, while processes such as adsorption (on suspended solids and sediment) serve only for storage. Few chemicals have been studied in sufficient detail such that quantitative predictions on the relative importance of each process can be made.

4.628
Adsorption onto Suspended Solids and Sediments, and Uptake by Aquatic Life. An important factor involving organic molecules is their mode of transport and fate after discharge into an aqueous environment. In particular, the degree to which they are adsorbed onto suspended matter, incorporated into bottom sediments, or bioaccumulated, is of importance. The n-octanol/water partition coefficient for a chemical is the equilibrium ratio of its concentration in octanol to its concentration in water in an octanol/water system. Low concentrations of the chemical are assumed. Although while one large compilation of octanol/water partition coefficients has been published (4-36), data



Source: Arthur D. Little, Inc.

FIGURE 4– 73 SIMPLIFIED SCHEMATIC DIAGRAM OF SOME PROCESSES ACTING ON ORGANIC CHEMICALS IN WATER

for many chemicals of interest are not available. Crude estimates (useable within one order of magnitude) may be made for these chemicals using the correlation between water solubility and octanol/water partition coefficient given by Chiou, et. al. (4-37) Alternatively, the partition coefficient may be estimated by considering the (additive) contributions of individual substructures of the molecule of interest. (4-36)

4.629
Water solubilities and octanol/water partition coefficients for two classes of organic chemicals the cyclic and polycyclic compounds, and halogenated hydrocarbons are presented in Table 4-304. Chemicals on the EPA consent decree list are identified. Missing data have not been estimated in this report, though this can usually be done by comparing one chemical with another in the table with a similar source. The log of the octanol/water partition coefficient (P) is given; thus, for example, for anthracene where log P = 4.45, P = 28,000. Table 4-305 gives similar data for a limited number of noncyclic hydro-carbons. In this case, missing partition coefficient data were estimated by Arthur D. Little, Inc., using the correlation with water solubility given by Chiou, et. al. (4-37) The partition coefficients given in Tables 4-304 and 4-305 indicate a generally high tendency for the chemicals to adsorb on soils (especially organic matter) and to bioaccumulate. Concentration factors ranging from a few hundred to tens of thousands are indicated.

4.630
The correlation of bioaccumulation with octanol/water partition coefficients discussed above must be considered to be somewhat tentative. At present, there are only limited data available with which the correlation can be checked. However, most of the data tend to indicate that the correlation is valid, at least for persistent chemicals, i.e., those that are not easily metabolized, biodegraded, or otherwise altered. Other studies on bioaccumulation (i.e., those where no specific correlation with the octanol/water partition coefficient was examined) suggest that such a correlation should exist. For example, Clayton, et. al. (4-38) in the abstract of a recent study of polychlorinated biphenyls in coastal marine zooplankton, concluded that:

> "For the low levels detected in sea water (0.7-3.4 ppt), data suggested that bioaccumulation is predominantly controlled by equilibrium partitioning of the chemical between the internal lipid pools of the biota and ambient water...The results from this study provide good evidence that at least for pelagic biota at the lower trophic levels, food chain biomagnification is not a controlling factor in attaining the observed residue levels."

Table 4- 3?4

Water Solubilities and Octanol/Water Partition Coefficients for Selected Organic Chemicals (1)

Compound	Empirical Formula	Water Solubility (2) (ppm)	Log (N-Octanol/Water Partition Coefficient) (3)
*Acenaphthene	$C_{12}H_{10}$	N/A	N/A
*Acenaphthylene	$C_{12}H_8$	N/A	N/A
*Anthracene	$C_{14}H_{10}$	0.075 (15°C)	4.45
*1,2-Benzanthracene	$C_{18}H_{12}$	N/A	N/A
*Benzene	C_6H_6	820 (2?°C)	2.13
*3,4-Benzofluoranthene	$C_{20}H_{12}$	N/A	N/A
*11,12-Benzofluoranthene	$C_{20}H_{12}$	N/A	N/A
Benzoic acid	$C_7H_6O_2$	2700 (18°C)	1.87
*1,12-Benzoperylene	$C_{22}H_{12}$	N/A	N/A
*Benzo(a)pyrene	$C_{20}H_{12}$	0.004 (15°C)	6.04
Bibenzyl	$C_{14}H_{14}$	N/A	4.79
Biphenyl	$C_{12}H_{10}$	7.5 (25°C)	3.16 - 4.09
*Bromoform	$CHBr_3$	3190 (30°C)	N/A
Carbon tetrachloride	CCl_4	800 (20°C)	2.64
*Chlorobenzene	C_6H_5Cl	448 (30°C)	2.84
Chloroethane	C_2H_5Cl	5740 (20°C)	1.54
Chloroform	$CHCl_3$	7950 (25°C)	1.97
*2-Chloronaphthalene	$C_{10}H_7Cl$	N/A	N/A

All notes appear on the last page of this table.

Table 4- 304 (Continued)

Compound	Empirical Formula	Water Solubility[2] (ppm)	Log (N-Octanol/Water Partition Coefficient)[3]
*2-Chlorophenol	C_6H_5ClO	28500 (20°C)	2.47 - 2.50
3-Chlorophenol	C_6H_5ClO	26000 (20°C)	2.15 - 2.19
4-Chlorophenol	C_6H_5ClO	27100 (20°C)	2.39 - 2.44
2-Chlorotoluene	C_7H_7Cl	N/A	3.42
3-Chlorotoluene	C_7H_7Cl	N/A	3.28
4-Chlorotoluene	C_7H_7Cl	N/A	3.33
*4-Chloro-3-methyl phenol	C_7H_7ClO	N/A	3.10
*Chrysene	$C_{18}H_{12}$	0.0015 (15°C)	5.61
Cyclophane	$C_{16}H_{16}$		2.33
1,2,7,8-Dibenzanthracene	$C_{22}H_{14}$	0.012 (27°C)	N/A
*1,2:5,6-*Dibenzanthrene*	$C_{22}H_{14}$	N/A	N/A
2,4-Dibromophenol	$C_6H_4Br_2O$	1900 (15°C)	2.56
*Dichlorobromomethane	$CHCL_2Br$	N/A	N/A
*1,2-Dichlorobenzene	$C_6H_4Cl_2$	145 (25°C)	3.38
*1,3-Dichlorobenzene	$C_6H_4Cl_2$	123 (25°C)	3.38
*1,4-Dichlorobenzene	$C_6H_4Cl_2$	79 (25°C)	3.39
*1,1-Dichloroethane	$C_6H_4Cl_2$	5500 (20°C)	N/A
*1,2-Dichloroethane	$C_6H_4Cl_2$	8690 (20°C)	N/A
2,4-Di-iodophenol	$C_6H_4I_2O$	N/A	3.08
*2,4-Dichlorophenol	$C_6H_4Cl_2O$	4600 (20°C)	N/A

Table 4-30M (Continued)

Compound	Empirical Formula	Water Solubility[2] (ppm)	Log (N-Octanol/Water Partition Coefficient)[3]
*2,4-Dimethylphenol	$C_8H_{10}O$	N/A	N/A
2,6-Dimethylphenol	$C_8H_{10}O$	N/A	2.36
*2,4-Dinitrotoluene	$C_7H_6O_4N_2$	270 (22°C)	N/A
*2,6-Dinitrotoluene	$C_7H_6O_4N_2$	N/A	N/A
Diphenylmethane	$C_{13}H_{12}$	N/A	4.14
Ethylbenzene	C_8H_{10}	140 (15°C)	3.15
3-Ethylphenol	$C_8H_{10}O$	N/A	2.40
4-Ethylphenol	$C_8H_{10}O$	N/A	2.66 - 2.81
*Fluoranthene	$C_{16}H_{10}$	N/A	N/A
*Fluorene	$C_{13}H_{10}$	N/A	N/A
*Hexachlorobenzene	C_6Cl_6	N/A	N/A
*Hexachloroethane	C_2Cl_6	N/A	N/A
Hexafluorobenzene	C_6F_6	N/A	2.22
*Iodeno (1,2,3-C,D) pyrene	$C_{22}H_{12}$	N/A	N/A
1-Methyl-1-1,2-benzanthrene	?	0.055 (27°C)	N/A
*Methyl bromide	CH_3Br	900 (?)	N/A
*Methyl chloride	CH_3Cl	9000 (?)	N/A
Methyl iodide	CH_3I	14000 (20°C)	1.69
6-Methyl chrysene	$C_{19}H_{14}$	0.065 (27°C)	N/A
*Methylene chloride	CH_2Cl_2	20000 (20°C)	N/A

Table 4- 304 (Continued)

Compound	Empirical Formula	Water Solubility (ppm)[2]	Log (N-Octanol/Water Partition Coefficient)[3]
4,5-Methylene phenanthrene	?	1.1 (27°C)	N/A
* Napthalene	$C_{10}H_8$	30 (15°C)	3.01 - 3.45
1,2-Nitrotoluene	$C_7H_7O_2N$	653 (30°C)	2.30
1,3-Nitrotoluene	$C_7H_7O_2N$	498 (30°C)	2.40 - 2.45
1,4-Nitrotoluene	$C_7H_7O_2N$	442 (30°C)	2.37 - 2.42
* Parachlorometacresol	C_7H_7ClO	N/A	3.10
* Pentachlorophenol	C_6HCl_5O	N/A	5.01
* Phenanthrene	$C_{14}H_{10}$	1.6 (15°C)	4.46
* Phenol	C_6H_6O	67000 (16°C)	1.46 - 1.48
Picene	$C_{22}H_{14}$	0.0025 (27°C)	N/A
* Pyrene	$C_{16}H_{10}$	0.16 (27°C)	N/A
* 1,1,2,2-Tetrachloroethane	$C_2H_2Cl_4$	N/A	N/A
* Tetrachloroethylene	C_2Cl_4	N/A	N/A
* Toluene	C_7H_8	470 (16°C)	2.11 - 2.80
* 1,2,4-Trichlorobenzene	$C_6H_3Cl_3$	N/A	N/A
* 1,1,1-Trichloroethane	$C_2H_3Cl_3$	N/A	2.49
* 1,1,2-Trichloroethane	$C_2H_3Cl_3$	N/A	2.49
* Trichloroethylene	C_2HCl_3	1000	N/A
2,4,5-Trichlorophenol	$C_6H_3Cl_3$	N/A	3.72
2,4,6-Trichlorophenol	$C_6H_3Cl_3$	800 (25°C)	3.06

Table 4-304 (Continued)

Compound	Empirical Formula	Water Solubility[2] (ppm)	Log (N-Octanol/Water Partition Coefficient)[3]
Triphenylene	$C_{18}H_{12}$	0.038 (27°C)	N/A
1,2-Xylene	C_8H_{10}	196 (15°C)	2.77
1,3-Xylene	C_8H_{10}	196 (25°C)	3.20
1,4-Xylene	C_8H_{10}	198 (25°C)	3.15

N/A = Not Available.

* - EPA Consent Decree Compounds

(1) The list of chemicals given here is for example purposes only (see text). There is no implication intended as to the presence or absence of these chemicals in the effluent.

(2) Solubility data are from the following two sources:

a) Handbook of Chemistry and Physics, 44th Edition, Chemical Rubber Publishing Company.

b) Manual on Disposal of Refinery Wastes, Volume of Liquid Wastes, American Petroleum Institute, 1969.

(3) Partition coefficients are from: "Partition Coefficients and Their Uses," Albert Leo, Corwin Hausch, and David Elkins, Chemical Reviews, 71(6), pages 525-616, 1971. Values for benzo(a)pyrene and chrysene are from: "The Environmental Fate of Selected Polynuclear Aromatic Hydrocarbons," United States Environmental Protection Agency, February, 1976 (EPA-560/5-75-009).

Table 4- 3?5

Water Solubility and Octanol/Water Partition Coefficient for Selected Non-Cyclic Hydrocarbons

Compound	Empirical Formula	Water Solubility[1] (ppm)	Log (Octanol/Water Partition Coefficient)[2]
1,5-Hexadiene	C_6H_{10}	N/A	2.45[3]
Hexane	C_6H_{14}	138 (15°C)	2.8
Heptane	C_7H_{16}	52 (15°C)	3.2
2,3-Dimethylhexane	C_8H_{18}	0.13 (25°C)	5.0
2,2,4-Trimethylpentane	C_8H_{18}	0.56 (25°C)	4.5
n-Octane	C_8H_{18}	15 (15°C)	3.6
n-Nonane	C_9H_{20}	6 (15°C)	3.9
n-Dodecane	$C_{12}H_{26}$	0.2 (15°C)	5.0
n-Tridecane	$C_{13}H_{28}$	0.013 (25°C)	5.8
n-Octadecane	$C_{18}H_{38}$	0.007 (25°C)	6.0

N/A = Not Available.

(1) From "Manual on Disposal of Refinery Wastes, Volume on Liquid Wastes," American Petroleum Institute, Washington, D.C., 1969.

(2) Estimates, except as indicated, based on relationship of water solubility and octanol/water partition coefficient given by Chiou, C.T., Freed, V.H., Schmedding, D.W. and Kohnert, R.L., "Partition Coefficient and Bioaccumulation of Selected Organic Chemicals," Environmental Science and Technology, 11(5), pages 475-478, 1977.

(3) From: Leo, A., Hansch, C., and Elkins, D., "Partition Coefficients and Their Uses," Chemical Reviews, 71(6), pages 525-616, 1971.

4.631
The study was inconclusive concerning bioaccumulation at higher trophic levels. These authors also cite the earlier work of Hamelick, et. al. (4-39), which implied that biota-water exchange equilibria for environmentally stable compounds are established in fish by rapid exchange across gill surfaces and subsequent transport to and from internal lipid pools via the circulatory system.

4.632
Evaporation. Evaporation of organic solutes from water into the air may be an important partway (for loss from solution) for most low molecular weight, hydrophobic chemicals. This includes the low molecular weight, simple hydrocarbons (e.g., methane, ethane, propane, etc.) and their halogenated counterparts (e.g., methyl chloroform, chloroethane, chloroform, etc.). The results of laboratory determinations of evaporation rates for a number of low molecular weight, chlorinated hydrocarbons are shown in Table 4-306. In these experiments, the loss of each chemical --initially present at 1 ppm -- from a stirred beaker (200 rpm) at 25 °C was measured with time. Addition of various contaminants (clay, limestone, sand, salt, peat moss, and kerosene) to the water had relatively little effect on the chlorinated compounds' evaporation rates. The data indicate that the listed chemicals would not persist in agitated natural water bodies due to evaporation. There is enough movement in the near shore waters at Lake Erie to allow a relatively rapid evaporation of these low molecular weight, hydrophobic compounds. Half-lives for evaporation on the order of days to weeks are likely. While in higher molecular weight, hydrophobic compounds it may to be on the order of weeks to months. As shown in Figure 4-78, some evaporated chemicals may be returned to surface waters by direct air/water transport or by rain which has washed the chemical out of the air. The interchange of organic chemicals between air and water cannot take place during the periods when ice covers the lake.

4.633
Photolysis and Photochemical Oxidation. Light may have a strong effect on the transformation of organic substances in water, even though the mechanisms remain obscure. There are three general types of light initiated processes that may have significance for the transformation of aquatic pollutants: photolysis, photochemical oxidation, and photosensitized oxidations. Typical compounds which undergo light-induced reactions include benzo(a)pyrene, metallic complexes of nitrolotriacetate and ethylenediamine tetraacetate, 2,4-D esters, and pesticides including malathion. Light-induced reactions lead to the formation of new chemicals. It is not possible to predict what these new chemicals will be since several mechanistic processes may be involved, including oxidation, reduction, displacement, elimination, and isomerization. These light-induced reactions may be a significant destruction pathway for discharged chemicals during

Table 4-306

Evaporation Rates of Chlorinated Compounds
From Dilute Aqueous Solutions

Compound	Time for Evaporation From Water (Min) 50%, τ	90%	Compound	Time for Evaporation From Water (Min) 50%, τ	90%
CH_3Cl	27	91	$CH_2{=}CHCl$	26	96
CH_2Cl_2(a)	19	60	$CH_2{=}CCl_2$	22	89
	19	67	$CHCl{=}CHCl$ (cis)	18	64
	24	80	$CHCl{=}CHCl$ (trans)	24	83
$CHCl_3$(a)	18	62	$CHCl{=}CCl_2$(a)	19	63
	20	68		21	63
	25	83		24	80
CCl_4	29	97	$CCl_2{=}CCl_2$(a)	24	72
CH_3CH_2Cl	21	79		25	86
CH_3CHCl_2	22	109		28	90
CH_2ClCH_2Cl	29	96	$CH_2ClCHClCHCl_2$	51	>120
CH_3CCl_3(a)	17	63	$CH_2ClCCl_2CH_2Cl$	47	>120
	20	65	$CH_2{=}CHCH_2Cl$	27	89
	23	80	$CH_2{=}CClCH_3$	29	110
$CH_2ClCHCl_2$	21	102	$CHCl{=}CHCH_3$	16	59
CH_2ClCCl_3	43	>120	$CH_2{=}CClCH_2Cl$	20	68
$CHCl_2CHCl_2$	56	>120	$CHCl{=}CHCH_2Cl$ (cis and trans)	31	98
$CHCl_2CCl_3$	48	>140			
CCl_3CCl_3	45	>120	$CHCl{=}CClCH_2Cl$	49	>140

[a] Results of three separate runs are given.

Source: W.L. Dilling, et al., Environmental Science and Technology, 9 (a), pp. 833-838, 1975.

certain times of the year. The reactions will be aided by strong sunlight penetration, (sunny, summer days when the sun is near its zenith). In winter, the low angle of the sun, short days, high cloud cover, and ice cover probably reduce light-initiated reactions to insignificant levels.

4.634
Hydrolysis. A number of organic compounds are sufficiently reactive to undergo hydrolysis including the halogen substituted alkanes and alkenes, esters, amides, anhydrides, epoxides, phosphates, and others. It is likely that hydrolysis will be a significant degradation pathway for many of these chemicals. However, hydrolysis is probably not a significant degradation pathway for unsubstituted hydrocarbons, e.g., benzene, toluene, naphthalene, etc. The hydrolysis reaction may be catalyzed by acids and/or bases, therefore, the pH of the water is important. Other than pH, important parameters are the temperature (hydrolysis rates increase with increasing temperature) and the presence of other chemicals in water which may assist or hinder the reaction. Half-lives for initial hydrolysis reaction in water vary from a few seconds to several years for those organic chemicals susceptible to hydrolysis. These reactions may be catalyzed or hindered by a variety of substances (acids, bases, heavy metals) so that the actual half-lives due to hydrolysis could vary significantly from one water body to another. Hydrolysis often leads to complete oxidation or degradation for the organic acids or alcohols that tend to be more readily broken down biologically than the parent compounds are.

Biodegradation

4.635
A variety of reactions may occur in biodegradation including reduction, oxidation, bondbreaking, and many others. Thus, a variety of intermediates may be formed, some of which may be resistant to further degradation. Complete degradation, by aerobic microbes, would lead to the formation of carbon dioxide and water from the hydrocarbon portion of the molecule. The amount of oxygen consumed in such a reaction should be the same as the COD which is measured in the laboratory with the use of a strong oxidizing agent. The applicant anticipates that essentially all the organic compounds to be expected in the proposed plant discharge will be biodegradable, though the rates of degradation may vary widely from chemical to chemical. Those chemicals resembling natural compounds will be degraded faster. There is, little data that would allow a prediction of biodegradation half-lives under the natural conditions of Lake Erie. Degradation should proceed more easily if a large variety of microbes is present in the water. During the winter months, when microbial populations are reduced, the importance of this degradation pathway will be diminished.

Inorganic Chemicals

4.636
Types of Inorganic Chemicals Present. The general nature of the main effluent to be expected from the proposed plant has been previously described. It would be a lengthy process to describe the fate of each inorganic species, but some qualitative comments on three general classes will be given. These classes are: (1) the non-metallic cations; (2) anions; and, (3) heavy metals. The chemical constituents within each class which are considered important are shown in Table 4-307.

Nonmetallic Cations

4.637
Hydrogen Ion (H^+ or H^1O^+). It is expected that the pH of the discharged effluent will be very close to neutral (pH = 7.0) and, thus, the concentration of hydrogen ions will generally be about 10^{-7} moles/liter. Excursions of pH in the effluent away from neutral would be somewhat lessened by the natural buffering afforded by dissolved minerals in the lake water, such as carbonates, bicarbonates, phosphates, and hydroxides. Thus, a simple dilution calculation for hydrogen ions (i.e., dilution due to mixing with lake waters) is not appropriate. The capacity of natural waters to buffer acids is measured as alkalinity; typical values for Lake Erie range close to 100 mg/l as ($CaCO_3$). This is well above the minimum USEPA criterion of 20 mg/l for the protection of freshwater aquatic life. (4-40) The lowest pH likely for the effluent is six, which corresponds to a hydrogen ion concentration of 10^{-6} moles/l. While this should not be harmful to aquatic life (unless rapid fluctuations are involved), a return to the natural pH of the lake should be rapid due to the more than adequate buffering capacity. It is interesting to note that rainfall is likely to be much more acidic than the proposed plant's effluent. The pH of rainfall at various locations in eastern U. S. including the proposed site ranges from about four to six with 4.5 being typical. (4-41)

4.638
Ammonium (NH_4^+). Ammonia in water can exist in either an ionized or un-ionized form as shown by the equation below:

$$NH_3 \cdot H_2O \quad NH_4^+ + OH^-.$$

In this equation, $NH_3 \cdot H_2O$ represents un-ionized ammonia gas in association with water. The toxicity of aqueous solutions of ammonia is attributed to the un-ionized NH_3 species, and the concentraion of this species will depend on pH as well as the concentration of

Table 4- 307

Important Inorganic Species Contained in the Effluent from the Proposed Plant

1 Non-Metallic Cations	2 Anions	3 Heavy Metals	
Hydrogen (H^+ or H_3O^+)	Cyanide (CN^-)	Antimony	Manganese
Ammonium (NH_4^+)	Chloride (Cl^-)	Arsenic	Tin
	Fluoride (F^-)	Cadmium	Zinc
	Hydroxyl (OH^-)	Chromium	Nickel
	Phosphate (PO_4^{-3})	Iron	Silver
	Sulfate ($SO_4^=$)	Lead	Selenium
	Sulfide ($S^=$)		
	Nitrite (NO_2^-)		
	Nitrate (NO_3^-)		
	Thiocyanate (SCN^-)		
	Ferrocyanide ($Fe(CN)_6^{-4}$)		
	Ferricyanide ($Fe(CN)_6^{-3}$)		

Source: Arthur D. Little, Inc. estimates.

total ammonia (NH_3 + NH_4^+) in solution. The percent of un-ionized ammonia at various temperatures and pH values is shown in Table 4-308. These data indicate that if the proposed plant's effluent contained 4 mg/l total ammonia at a pH of 7.0 and a temperature of 20°C, then 0.016 mg/l (0.4 percent) would exist in the un-ionized form. The EPA criterion for ammonia is 0.02 mg/l as un-ionized ammonia for the protection of fresh water aquatic life. However, the effluent from the proposed plant is projected by the applicant contain about 0.96 mg/l of total ammonia on average, and 3.1 mg/l in a worst-case situation. If mixing the lake waters in the mixing zone reduced the concentraion to 1 mg/l and the temperature to 10°C, the concentration of un-ionized ammonia would be 0.0019 mg/l (at pH=7). At high pH, the percent of un-ionized ammnia increases greatly. It is, for example, 5.6 percent at a pH of 8.5 and a temperature of 10°C. (Refer to table 4-274 for a discssion on the range of temperature and pH expected in the plant effluent). The un-ionized ammonia in the water could be readily volatilized and transported into the air. However, it is not known if this is a significant pathway for the loss of ammonia from the aquatic environment. Various chemical reactions in water are possible for ammonia including the formation of chloramines. Biological nitrification of ammonia to nitrite and, subsequently, nitrate is possible. This is likely to be an important reaction in any biological waste treatment system; it may be a major contributor to nitrite and nitrate levels in the area affected by the discharge, but will probably not be an important pathway for ammonia removal in Lake Erie.

Anions

4.639
The anions expected in the plant effluent (refer to Table 4-307) are likely to be relatively long-lived in the aqueous environment. This is especially true for the more soluble anions such as chloride, sulfate, and nitrate. Some (e.g., fluoride), will be relatively easily removed and incorporated into the sediments because they form salts with very low solubilities. Cyanide, like ammonia, may exist in water in both ionized and un-ionized forms. Fifty percent ionization of the acid HCN occurs at about pH 9.3 and the percent of the un-ionized form increases rapidly as the pH is lowered. HCN is probably the most toxic form of cyanide in water. The persistence of cyanide in water is apparently highly variable and may depend on the chemical form of the cyanide, the concentration, and nature of other constituents present. At moderate to low pH, some volatilization may take place. Under most conditions, some biodegradation by either aerobic or anaerobic microbes is likely. (4-40) The above discussion deals with free cyanide, i.e., with cyanide that is amenable to chlorination. The proposed plant's effluent will also contain cyanide complexes (not amenable to chlorination) in quantities

Table 4- 308

Percent of Un-ionized Ammonia in Aqueous Ammonia Solutions

Temperature (°C)	pH Value 6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
5	0.013	0.040	0.12	0.39	1.2	3.8	11.	28.	56.
10	0.019	0.059	0.19	0.59	1.8	5.6	16.	37.	65.
15	0.027	0.087	0.27	0.86	2.7	8.0	21.	46.	73.
20	0.040	0.13	0.40	1.2	3.8	11.	28.	56.	80.
25	0.057	0.18	0.57	1.8	5.4	15.	36.	64.	85.
30	0.080	0.25	0.80	2.5	7.5	20.	45.	72.	89.

Source: Quality Criteria for Water, United States Environmental Protection Agency, Wahsington, D.C., 1976.

roughly eight times that for free cyanide. Data indicate that the thiocyanate complex (CNS^-) probably accounts for the vast majority of the complexed cyanide in the untreated wastewaters, at least that portion that is in the coke plant effluent. Thiocyanates may, however, be almost completely degraded in biological treatment systems, if the residence time is long enough, so that very little may be present in the treated effluent. A small portion of the complexed cyanide is likely to be in the form of ferrocyanide ($Fe(CN)_6^{-4}$ or ferrycyanide ($Fe(CN)_6^{-3}$); these complexes are not easily biodegraded. Data on untreated coke plant effluents at two plants showed the ratio of concentrations of important cyanide species to be as follows: (4-42)

	Relative Concentrations	
	Plant A	Plant B
Thiocyanate, as HCNS	26	11
Cyanide, as HCN	4.4	1.3
Ferrocyanide, as $(NH_4)_2Fe(CN)_6$	1	1

The applicant assumes that ferro- and ferricyanide complexes will have concentrations in the plant effluent on the same order of magnitude as the concentration for free cyanide.

4.640
Other metal-cyanide complexes may also be present in trace quantities. Their concentrations will probably be well below those for the iron complexes because: iron is more readily available in the effluent; and, the iron complexes are more stable than those for other common metals as indicated below: (4-42, 43)

Complex	Approximate Dissociation Constant	
$Zn(CN)_4$-2	10^{-20}	
$Ni(CN)_4$-2	10^{-22}	
$Mn(CN)_6$-3	10^{-27}	
$Fe(CN)_6$-4	10^{-37}	Increasing
$Hg(CN)_4$-2	10^{-42}	Stability
$Fe(CN)_6$-3	10^{-44}	

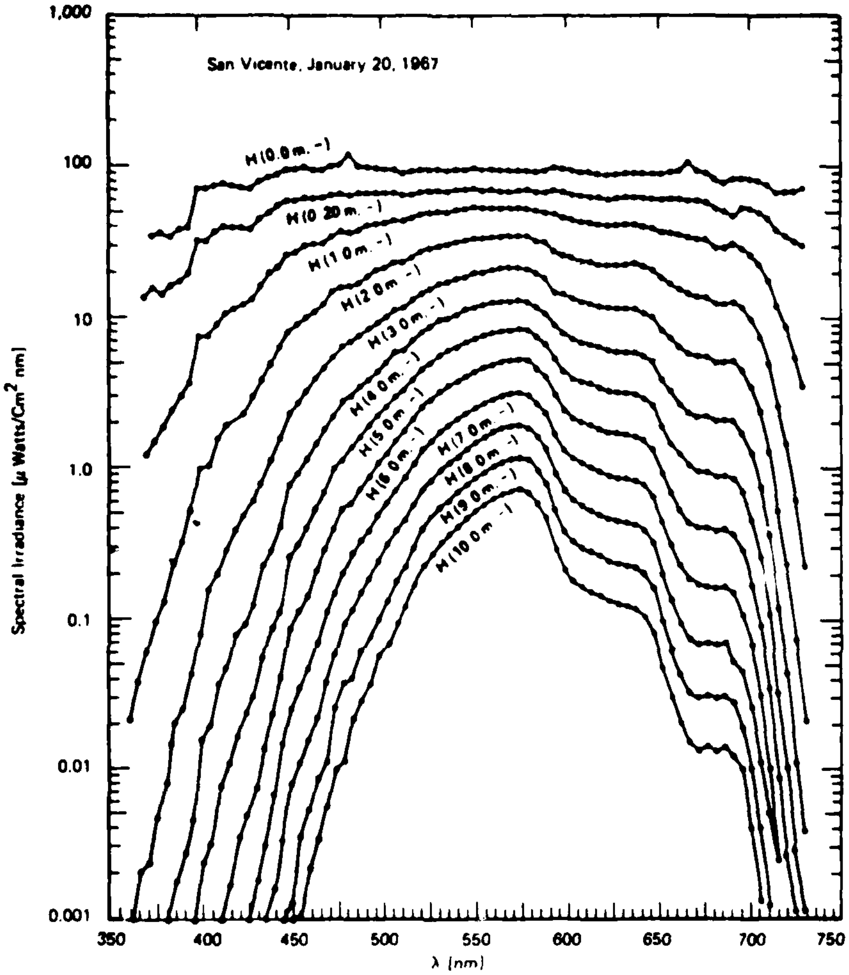
It is known that light can initiate reactions with metal-cyanide complexes producing, presumably, free cyanide. (4-40, 43, 44, 45) Thus, a diurnal fluctuation in the concentration of free cyanide is possible where these complexes and adequate light are available. It has been reported that in one study of the photolysis of $K_3(CN)_6$ compounds (M=metal), the ease of reaction was in the order of Mn, FE,

Cr, Co. (4-125) The rates of photolysis for the iron-cyanide complexes are not known, but there are some data that indicate that it is not very fast. Experimentor have measured the rate of exchange of CN^- ions between free solution and the $Fe(CN)_6$-4 complex. In a system containing equal concentrations of the two species at pH=10.3, less than five percent exchange was seen after 77 hours in the dark; the half-life for exchange (i.e., 50 percent exchange) in the light was 33 hours. (4.43) This evidence is apparently contradicted, however, by field tests (on ion-cyanide breakdown in surface waters) currently being conducted by the University of Minnesota. Preliminary results indicate that the complexes do break down fairly rapidly where light penetration is strong. (4-46)

4.642
There is also evidence that suggests that such photolysis reactions, would only be significant very near the surface in the ice-free portions of the year. The ultraviolet portion of sunlight is strongly attenuated both in the atmosphere and the water. Eutrophic lakes in particular, strongly attenuate ultraviolet lights as shown in Figure 4-79. Thus, the photolysis of iron-cyanides to liberate free cyanide in Lake Erie could only be significant near the lake surface. There are insufficient data to quantitatively estimate the magnitude of diurnal fluctuations that might result. Total soluble sulfide in the effluent is projected to be about 0.027 mg/l. The sulfide will either be in the form of H_2S or HS^-, with the latter being the less toxic. The proportion will depend primarily on the pH (4-40):

at pH	Percent in form of H_2S
5	99
7	50
9	1

4.643
Since the effluent from the proposed plant is expected to have (on average) a pH near 7, the 50 percent value is applicable. The EPA criterion for sulfide is 2 ugl undissociated H_2S. (4-40) The concentration of sulfide from the proposed plant effluent is expected to be well below this level at the edge of the mixing zone. Some fulfide may also be lost due to oxidation to sulfate, volatilization of H_2S, and/or precipitation of insoluble metal sulfides. These processes will eventually remove most of the plant-discharged sulfide. All of the anions mentioned may form various compounds (salts or complexes) with certain other chemicals (e.g., heavy metals). While some of these reactions may remove the anion from the aqueous environment (e.g., by precipitaiton) or otherwise inactivate it, the amounts so removed or inactivated may be a negligible fraction of the total anion concentration.



Source: Tyler, John E. "Transmission of Sunlight in Natural Water Bodies," Program and Abstracts, Symposium on Nonbiological Transport and Transformation of Pollutants on Land and Water Process and Critical Data Required for Predictive Description, May 11–13, 1976, National Bureau of Standards, Gaithersburg, Maryland

FIGURE 4– 79 IRRADIANCE MEASUREMENTS AS A FUNCTION OF WAVELENGTH AND DEPTH IN A EUTROPHIC LAKE

Heavy Metals

4.644
Most heavy metals easily form insoluble compounds with a variety of anions including sulfide, hydroixide, carbonate, oxalate, and phosphate. Of these, the sulfide compounds generally result in the lowest equilibrium concentration of the free metal. For example, the equilibrium concentration of cadmium (Cd^{+2} in a solution containing an excess of sulfide ions is about 7 X 10^{-0} mg/l. Equilibrium values for other metals in an excess sulfide solution are as follows: copper (Cu^{2+}), 6 X 10^{-18} mg/l; iron (Fe^{2+}), 3 X 10^{-5} mg/l; nickel (Ni^{2+}), 7 X 10^{-8} mg/l; zinc (Zn^{2+}, 2 X 10^{-7} mg/l; antimony (Sb^{3+}), 3 X 10^{-6} mg/l; and silver (Ag^{+}), 4 X 10 mg/l.

4.645
A variety of other reactions, or mechanisms, also serve to inactivate heavy metals ror to remove them from the water column. Inactivation can result from chelation. Chelation agents are compounds that coordinate or bind a metal ion in more than one position. The metal thus becomes the central ion in a heterocyclic ring. While the resulting chelation complex may be soluble, the metal ion, now bound, is no longer able to react chemically. A variety of naturally occurring organic chemicals (including citric and gluconic acids) capable of chelating heavy metals may be present in Lake Erie and, some deactivation through this mode may be expected. Heavy metal cations may also be removed from solution by adsorption onto suspended solids or sediments. With some clay materials, the proces is known to include a catio exchange with other metals (e.g., Na^{+} or Ca^{++})or with hydrogen ($H.^{+}$). It is not known what fraction of the heavy metals expected in the proposed plant discharge will be in a soluble form and what fraction will be in an insoluble form (i.e., already tied up as a precipitate or incorporated in solid mineral matter). However, it is apparent that significant quantities of these metals may ultimately end up in the lake sediments. Some equilibrium would eventually be reached at the sediment/water interface and this equilibrium may differ for each metal. In addition, the equilibrium may be shifted in different directions or to different extents by subsequent changes in pH and the oxidizing or reducing nature of the sediments and water. For metals that are initially transported for some distance from the outfall in an insoluble form, dilution and oxidation may be important factors in their conversion to soluble forms.

Nutrient Loading

4.645a.
During the review of the Draft EIS, comments were received relative to the proposed steel mill's impact on nutrient levels in Lake Erie

and streams in the Regional Study Area. Specifically, increases in nitrogen and phosphorous were identified as the primary concern since these nutrierts are linked to high biological productivity and dissolved oxygen depletions caused by over production of algae and other plankton. Nutrients, especially phosphorus, can stimulate algal production and overload the lake with organic matter. As this material falls to the bottom, it consumes dissolved oxygen leading to anoxia in the deeper portions of the lake. Also, growing plants assimilate nitrate or ammonia ions and convert them to protein. Phosphorous is one of the major nutrients required for plants. During the past 30 years, the belief has developed that increased standing crops of aquatic plants frequently are caused by increased supplies of phosphorous. Generally, it is recognized that phosphorous allows use of other already available elements required for plant growth. Further, of all the elements required for plant growth, phosphorous is most easily controlled by man. With regard to the potential nutrient effects of the proposed mill on the central basin of Lake Erie, it is believed by the applicant that threshold concentrations of nutrients in this basin have not been determined thus making an assessment of limiting factors extremely difficult. While there is considerable speculation on the subject, the results of recent sampling programs conducted for this and other projects in the central basin consistently indicate more than enough phosphorous and nitrogen derivatives are available to support nuisance algal blooms. This suggests that other factors (e.g. light penetration or micronutrients) presently limit the extent of such nuisance growths in the central basin; and that increments added by the proposed plant may not result in increased algal growth. The addition of phosphorous to Lake Erie by industry is not necessarily contrary to the 1978 International Joint Commission's Great Lakes Water Quality Agreement which proposes limitation of phosphorous introduction to the maximum extent possible by industry but does not indicate zero discharge. Should such nutrients be determined limiting to nuisance growths at some point in the future (which is considered possible, but not likely), and should the levels of discharge of such nutrients by the applicant be considered unacceptable, a means has been created to remedy such a situation. This is because the applicant has commited to reduce the amounts of any constituents in its discharge to levels acceptable to the EPA. The nutrient effect on streams as a result of secondary development is discussed later in this chapter.

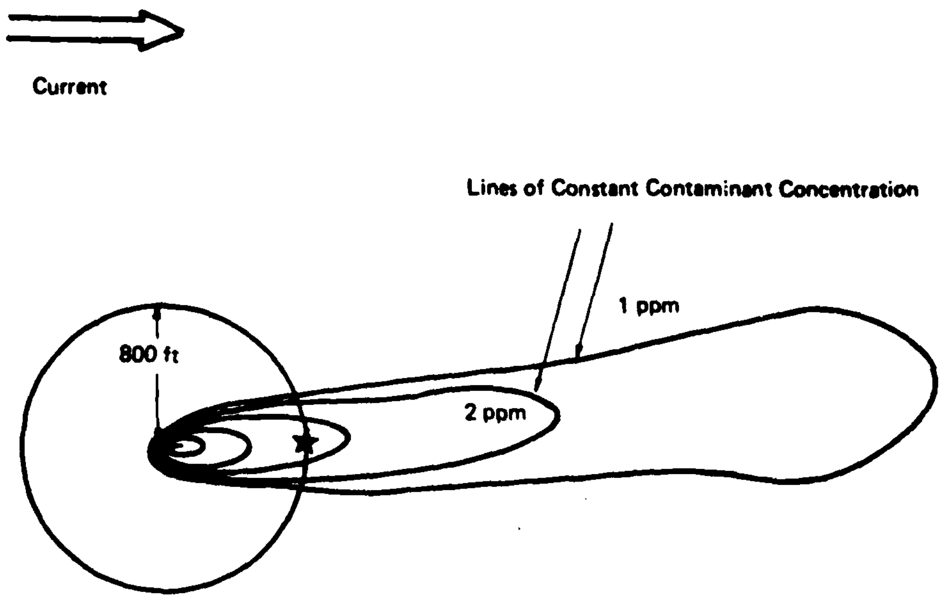
Effluent Diffusion

4.646
A computer model was used to estimate concentrations of various constituents in the effluent at the edge of a circle of 240 meters

(800 ft) radius for the purpose of comparison with Ohio Standards. This is not a proposed mixing zone definition. That definition can only be made by the Ohio EPA in its review of NPDES permit application an relevant data on the aquatic ecosystem. A technical description of the applicant's computerized models, and the applicant's rationale for discharge structure location and design are appended to this statement. Based on available data, and the proposed revisions to the Ohio water quality standards, it appears that a mixing zone of the site specified would not conflict with those criteria. The concentrations discussed below are those projected at the center of the discharge plume and would not be observed at all points on the circle. The relationship between the outfall, the plume, and the 240 meter (800 feet) circle is shown in Figure 4-80. The actual location of the plume centerline, and thus the maximum concentrations discussed below, would change with time, so the long-term mean concentration at any point on the circle may be significantly less than those presented in Tables 4-309 and 4-310.

4.647
Under typical conditions the following parameters are projected to meet proposed Ohio standards for waters of Lake Erie: ammonia, arsenic, cadmium, chromium, total cyanide, cyanide (A), dissolved oxygen, fluoride, iron, lead, manganese, oil & grease, and zinc. The following parameters are projected to exceed the proposed Ohio standards: phenols and total dissolved solids. Total dissolved solids are projected to typically exceed proposed standards under baseline conditions and consequently could be exceeded in the vicinity of the outfall regardless of project implementation. The contribution from the proposed discharge is small relative to baseline concentrations for total dissolved solids. The projected contribution of phenols from the plant effluent would cause the proposed Ohio standards to be exceeded to a distance of approximately 1,500 meters from the outfall location. Thus concentrations exceeding the standards would not typically extend to the shore, to Conneaut harbor, or to any existing or potential potable water intakes. Chlorophenols are not expected to be present above the effect level (1 ug/l) outside a 240 meter radius. These chemicals are expected to make up approximately five percent of the phenol loading in the plant effluent as shown earlier in this section. Assuming that ambient phenols are also five percent chlorinated leads to an estimate of chlorophenol concentration 240 meters from the outfall of 0.1 ug/l under typical conditions.

4.648
The worst case projection assumes that 10 percent of ambient phenols are chlorophenols, yielding 0.5 ug/l chlorophenols at 240 meters from the outfall. Under the worst case projection arsenic, chromium, total cyanide, cyanide (A), fluoride, iron, lead, and manganese are



+ Outfall Location

★ Concentration Reference Point

Note: The location marked with ★ is the reference point for all concentrations listed in tables in the Water Quality Impact section of this chapter. At all other points 800 ft. from the outfall the concentration will be less than indicated in those tables and the text.

FIGURE 4– 80 SCHEMATIC OF EFFLUENT PLUME

Table 4- 3()

Estimated Contaminant Concentrations in the Vicinity of Plant Outfall: Typical Conditions (mg/l)

	Ambient Concentration	Concentration 240m from Outfall	Ohio Standard
Dilution Factor	--	28.0	--
Ammonia[1]	0.04	0.073	1.5
Arsenic	0.001[3]	0.001	0.05[2]
Cadmium	0.001	0.001	0.0012
Chromium	0.005	0.006	0.050
Cyanide (Total)	0.0004	0.005	0.025
Cyanide (A)	0.0002[3]	0.0008	0.005
Dissolved Oxygen	11	11	6.0
Fluoride	0.13	0.18	1.8
Iron (Dissolved)	0.05	0.07	0.3
Lead	0.005	0.006	0.5
Manganese	0.01	0.017	0.05
Oil & Grease	1.0	1.1	5.0
Phenols	0.0006	0.0018	0.001
Total Dissolved Solids	200	210	200
Zinc	0.02	0.02	0.03

Notes:

All parameters "total" unless other specified; all concentrations in mg/l. All parameters assumed to be conservative, i.e., any chemical reactions which might alter these constituents are assumed to be not rapid enough to significantly alter concentrations within 1 km of the outfall.

(1) Typically, un-ionized ammonia concentrations are projected to be below 0.005 mg/l, under the Ohio standard of 0.025 mg/l.

(2) Value of 1.5 mg/l is for pH=7.8 and a temperature of 24°C. Standard for total ammonia depends on pH and temperature. Standard for un-ionized ammonia is 0.025 mg/l.

(3) Values are estimated.

Source: Arthur D. Little, Inc. estimates.

Table 4- 310

Estimated Contaminant Concentrations in the Vicinity of Plant Outfall: Worst Case (mg/1)

	Ambient Concentration	Concentration 240m from Outfall	Ohio Standard
Dilution Factor	--	17.0	--
Ammonia[(1)]	0.3	0.46	1.5[(2)]
Arsenic	0.005[(3)]	0.005	.05
Cadmium	0.005	0.005	0.0012
Chromium	0.010	0.013	0.050
Cyanide (Total)	0.0008[(3)]	0.023	0.025
Cyanide (A)	0.0005[(3)]	0.004	0.005
Dissolved Oxygen	7.0	6.8	6.0
Fluoride	0.20	0.46	1.8
Iron (Dissolved)	0.1	0.2	0.3
Lead	0.01	0.014	0.05
Manganese	0.02	0.04	0.05
Oil & Grease	5.0	5.3	5.0
Phenols	0.003	0.009	0.001
Total Dissolved Solids	250	290	200
Zinc	0.07	0.07	0.03

Notes:

All parameters "total" unless other specified; all concentrations in mg/l. All parameters assumed to be conservative, i.e., any chemical reactions which might alter these constituents are assumed to be not rapid enough to significantly alter concentrations within 1 km of the outfall.

(1) Projected concentrations of un-ionized ammonia would (not exceed 0.06 mg/l under worst case conditions. This is slightly greater than the highest baseline concentrations of un-ionized ammonic 0.04 mg/l) which are over the Ohio Standards. (See text for more detailed discussion.)

(2) Value of 1.5 mg/l is for pH=7.8 and a temperature of 24°C. Standard for total ammonia depends on pH and temperature. Standard for un-ionized ammonia is 0.025 mg/l.

(3) Values are estimated.

Source: Arthur D. Little, Inc. estimates.

projected to remain under the proposed Ohio standards. Ambient lake concentrations of un-ionized ammonia, cadmium, oil and grease, phenols, total dissolved solids, and zinc occasionally exceed Ohio standards at this time, and are expected to remain over the standards through 1990. The projected plant contributions to levels of cadmium, oil and grease, and zinc would be very small relative to ambient levels during the worst case scenario. The concentration of un-ionized ammonia is dependent on pH, temperature and the concentration of total ammonia. The ratio of un-ionized ammonia to total ammonia increases rapidly as pH and temperature are increased such that the highest levels of un-ionized ammonia occur during the summer when pH and temperature are both high. Analysis of two years of daily water intake data from Erie and Conneaut indicates that the fraction of total ammonia present in un-ionized form in the vicinity of the proposed intake will rarely exceed 15 percent. While at the Erie intake, that fraction never exceeded 11 percent. During this same period the fraction of total ammonia present as un-ionized ammonia exceeded 15 percent only once. Values exceeding five percent were restricted to the months of July through September. Examination of all available observations of total ammonia in the central basin indicate that levels of total ammonia in the surface waters rarely exceeded 0.2 mg/l during July, August, and September. The highest concentrations of total ammonia, exceeding 0.3 mg/l, occur during the fall turnover and during spring when tributary inputs are large.

4.649
The highest levels of un-ionized ammonia will occur during July through September when the temperature is over 20^{o}C and the pH is near 8.5. Total background ammonia concentrations would be at most 0.2 mg/l. Applying these conditions to a recalculation for the proposed effluent, it is found that the effluent would contain about 3.0 mg/l total ammonia. At the edge of a circle, 240 meters (800 feet) in diameter, the highest level of un-ionized ammonia would be approximately 0.05 mg/l compared with ambient levels of 0.03 mg/l. Due to the elevated temperature of the plume and the BOD of other constituents of the plant effluent, the potential for dissolved oxygen depletion in the plume has been investigated in terms of the worst case condition. For the purposes of this discussion, the worst case is described as stagnant lake conditions, effluent DO of 4.5 mg/l, and effluent BOD_5 of 11 mg/l. The near shore areas of the lake are generally well aerated by exchange with the atmosphere. Typical percent saturation values are 100 percent. However, under worst case, stagnant conditions, DO values of 7.0 mg/l, or 83 percent saturation at 23^{o}C have been observed. Ambient BOD_5 values of 1.7 mg/l are typical, and BOD_5 values of 3.0 mg/l are occasionally observed. Under these circumstances, dilution by mixing without any BOD_5/dissolved oxygen interaction would result in dissolved oxygen levels of 6.8 mg/l and BOD_5 of 3.5 mg/l at 240 meters (800 feet) from the outfall.

4.650
Utilizing an ambient currents velocity of 1.5 cm/sec and a discharge rate of 4m/sec, the applicant expects that these waters will remain within the 800-foot circle for 2-8 hours. It is possible that under extremely stagnant conditions, the contaminated water could remain in the vicinity of the outfall for one or two days. Thus, the five-day BOD values are not completely relevant to the estimation of oxygen depletion in the vicinity of the plume. However, in the case where a five-day biochemical oxygen demand (BOD_5) reaches a maximum within 800 feet of the outfall, the applicant estimates that under worst case conditions the dissolved oxygen concentration would be reduced to a minimum of 6.0 mg/l ($\pm$ 0.5 mg/l) in the vicinity of the outfall. Under typical conditions, the modeled decrease in dissolved oxygen attributable to the plant effluents is 0.1 mg/l at 240 meters (800 feet) from the outfall.

4.651
The U. S. Environmental Protection Agency has reviewed and analyzed the effluent diffusion and lake modeling sections of the Draft EIS and concluded that the results indicated for "typical" conditions are acceptable for assessment of water quality of Lake Erie resulting from the proposed facility. However, the "worst case" conditions (zero lake flow) are not adequately predicted by the LAKEPLUME Model. The specific problems associated with the model are outlined in a 15 February 1979 letter from the USEPA, which letter is appended to this Final Impact Statement. The USEPA states that results for "typical conditions" have shown violations of existing water quality standards as a result of the proposed discharge and these violations can only increase under "worst case" conditions. A discharge permit cannot be issued to a facility where violations of water quality standards will result. Therefore, the proposed effluent limitations and/or discharge port design must be altered to achieve existing water quality standards. To assist in this matter, the USEPA recommends the use of two reports (EPA-R2-72-005a and EPA-R2-72-005b) by M. A. Shirazi and L. R. Davis to simulate "worst case" conditions. The results can be obtained through the use of nomograms in these reports. Additionally, should the applicant use a different discharge configuration (i.e., specified diameter, number, and spacing of ports, etc.) from that used in the original modeling, the simulations should be rerun.

4.652
Alterations in effluent limitations and/or discharge port design along with adequate simulations of "worst case" conditions are matters to be resolved through the NPDES permit review. The U. S. Steel Corporation must submit a permit application to the Ohio EPA, which is responsible for administering NPDES permit program. The Ohio EPA has lead role, subject to USEPA overview, in the drafting and

issuance of NPDES permits and has the regulatory authority to require any additional information needed to complete its review of the application. If any additional information is requested but not provided, the Ohio EPA may deny their permit.

4.653
Parameters for Which Ohio Water Quality Standards Have not Been Established. COD values at 240 meters (800 feet) from the outfall are projected to be 11 mg/l typically, which is slightly above the background level of 10 mg/l. In the worst case COD is projected to reach 33 mg/l, which is above the background level of 25 mg/l. Total suspended solids loads are projected to be substantially unchanged from ambient at 800 feet from the outfall, with typical concentrations of 10 mg/l and high values of 21 mg/l. Specific conductance will be substantially unchanged 800 feet from the outfall at 310 umhos and 620 umhos, typical and worst case, respectively. Sulfides are projected to be present 240 meters (800 feet) from the outfall at concentrations of 3 ug/l, typical and 15 ug/l worst case. At the expected pH of about 8.0, 30 percent of the total sulfide will be present as undissociated H_2S (0.9 ug/l typical and 4.5 ug/l worst case.)

4.654
Long-Term Transport of Discharged Wastewater. One of the concerns associated with the chemical discharge is the expected long-term transport and fate of plant wastes. The prevailing flow is ENE towards Presque Isle. Observed currents flow in this direction over 40 percent of the time, and suspended sediments are known to be transported in this direction. The initial direction of travel of the wastewater will vary with fluctuating winds and currents. Based on available current observations, it is expected that the plume will proceed alongshore to the WSW and toward Conneaut Harbor roughly 25 percent of the time; onshore roughly 20 percent of the time; and offshore about 15 percent of the time. If the discharge is not located clear of the eddy near the harbor breakwall, it is likely that an onshore (southerly) or westerly direction of flow will occur at greater frequency than indicated above, while the frequency of ENE flow will be reduced. Very little of the discharged material will actually enter Conneaut Harbor because of the breakwater which impedes flow. Dissolved constituents of the effluent will generally be carried by lake currents past Presque Isle and into the Lake Erie eastern basin. In the passage between Long Point and Presque Isle, near-shore currents are predominantly easterly while offshore currents exhibit a return flow westerly into the central basin. Any material which, by horizontal diffusion or offshore transport, is carried into the offshore portion of this passage will be returned to the central basin. It is expected, however, that most dissolved constituents will ultimately be carried to the eastern basin.

Suspended material in the effluent would tend to settle to the lake bottom, especially during periods of low ambient currents and winds. Since bottom currents in the nearshore zone are generally ENE, it is expected that suspended material will eventually be deposited along the south shore (generally to the east of the proposed site), or in the central basin. Sedimentation rates are known to be much higher in the eastern basin than in the central basin, further indication that only a minor fraction of the material will be deposited in the central basin. A small fraction of the suspended material may be deposited in Conneaut Harbor, entering through the eastern and offshore gaps in the harbor breakwaters during episodes of westerly flow. In the protected confines of the harbor, the suspended materials would settle out.

4.655

Cooling Tower Blowdown Effluents from the Proposed Plant. Cooling tower blowdown would be discharged at a rate of 6,680 m^3hr; this constitutes 60 percent of the total estimated discharge of 11,100 m^3/hr. It is assumed here that this blowdown comes only from the various noncontact cooling systems in the plant or from other cooling systems where negligible amounts of contaminants are added to the water in the cooling process. The indirect cooling systems would have a total water recirculation rate of 88,000 m^3/hr. Aside from blowdown temperature, essentially no information has been provided by the applicant on the nature of (i.e., constituents of) these blowdown effluents. For the purposes of determining the environmental impact of blowdown discharges, it cannot be assumed that the blowdown chemistry is the same as the make-up water from Lake Erie. The reasons for this assumption are as follows:

(1) Cooling tower evaporation losses ("drift") cause the recirculating water and, thus, the blowdown to be concentrated for most constituents;
(2) Additives for control of corrosion, pH, and/or bacterial growth are commonly used in some cooling towers;
(3) Corrosion products (i.e., dissolved metals) and/or scale are likely to be present;
(4) Air moving through the cooling towers is essentially scrubbed by the water, resulting in a transfer of material from air to water;
(5) Some bacterial growth on the cooling towers is likely and, thus, bacteria and their decay products, including endotoxins, would be present;
(6) The elevated temperature alters the water chemistry in a variety of ways, e.g., saturation levels for DO are lowered;

4.656
Expected Concentration Factor. The expected concentration factor for the blowdown may be calculated on the basis of the following:

- That the cooling tower drift, 3,700 m^3/hr, comes only from indirect cooling systems. (Some will likely come from direct cooling systems; thus, the figure of 3,700 m^3/hr may be high.)
- That the cooling tower drift loss is all by evaporation (i.e., negligible droplet loss) of pure water with no loss of dissolved constituents.
- That no other loss or concentration factors are involved.

The concentration factor under these conditions is equal to the make-up volume required (3,700 m^3/hr), or 1.55. Thus, nonvolatile components in the makeup water would be concentrated roughly 50 percent in the blowdown waters. This concentration effect was taken into account in the calculations described earlier in this section for the estimation of parameter concentrations in the combined effluent.

4.657
Additives. Based on other experience with Lake Erie water, the applicant expects that three basic types of water treatment chemicals will be required to control the quality of water used in the indirect cooling water recycle systems. These are: (1) dispersants for deposit control; (2) corrosion inhibitors; and (3) biocides. Polymers will be required for the settling of solids in raw water clarification. The applicant has stated that additives containing heavy metals as part of the active ingredients will not be used in these systems. However, no additional information can be provided since the detailed plant engineering and design has not been developed.

Corrosion Products and Scale

4.658
Systems operated in a slightly acidic environment will tend to corrode at a faster rate than those operated in an alkaline environment. In either case, the use of inhibitors will not totally eliminate corrosion. Corrosion will add dissolved metal(s) to the circulating water; including iron, chromium, copper, manganese, zinc, or any other metal with which the water comes in contact. High levels of these metals can occur in the blowdown water if corrosion is not controlled. Systems operated in the alkaline mode may tend to form scale, though this can be controlled with inhibitors. Some scale can break loose and add to the suspended solids load of the circulating waters. The applicant has provided no information on the types of quantities of erosion inhibitors which will be used in the proposed Lakefront plant.

Transfer of Material from Air

4.659
The counter-current movement of air and water in the cooling towers not only cools the water, but allows a transfer of constituents from one medium to the other. For many constituents, a net transfer from the air to the water may be expected with the tower acting as an air scrubber. This is likely to be the case for particulates and any chemicals with a high water solubility and a high partial pressure in the air. A net transfer from the water to the air may occur for volatile chemicals with a relatively high concentration in the water and a low partial pressure in the air. This scrubbing effect could be particularly important for the proposed plant since the cooling towers would be operating in an industrial atmosphere. Specifically, relatively high ground level concentrations of particulates, hydrocarbons, and to a lesser extent sulfates may be expected although NO_x will not be significantly elevated at ground level. The degree of such scrubbing could vary depending on location and meteorological conditions.

4.660
The amounts of pollutants added due to a scrubbing are negligible; they are often less than one percent of the values in Table 4-297. The highest percentage contribution in the typical case, (based on available data) is 14 percent for lead. In the high, or maximum, case the contribution due to scrubbing in the cooling towers does fall in the range of 10 percent to 40 percent for lead, cadmium, ammonia, and arsenic, the contribution for zinc is over 100 percent; for all other chemicals, it is less than 10 percent.

4.661
The concentration of suspended solids in the blowdown (due to scrubbing) could add 130 kilograms per day of suspended solids in the wastewater discharge from the plant. This is just under three percent of the estimated total discharge of suspended solids, as shown in Table 4-310. Even smaller amounts would be expected to be discharged because the final equalization ponds would allow some of the suspened solids to settle out. Similar calculations were also carried out for SO^2 scrubbing from the air. Assuming that the SO^2 concentration was as high as 100 ug/m^3 in the air around the cooling towers, the results showed that less than 1 mg/l of sulfate would be added to the water. This is a negligible amount in comparison with the background levels in Lake Erie of 25-30 mg/l.

Bacterial Growth

4.662
Cooling towers are conducive to certain kinds of bacterial growth, induced, in part, by the elevated temperatures and easy availability

of nutrients. While the growths may be controlled, they are not all together avoided, and various organisms are, thus, likely to be present in the blowdown in numbers of kinds that are significantly different from Lake Erie waters. Their mass will also add to the suspended solids load. The products of decay of these organisms include endotoxins which could further degrade water quality.

Temperature Effects

4.663
Aside from inducing biological growth in the cooling towers, the elevated temperatures would also change the water chemistry. Solubilities of gases (e.g., oxygen and nitrogen) and low-molecular-weight organic chemicals would be lowered, resulting in a tendency for them to be lost to the atmosphere in the towers. Solubilities of other organic chemicals would, in general, be increased. Leaching of any wood preservatives from the towers would be accelerated as would certain chemical reactions, such as hydrolysis and oxidation.

Abnormal Events during Plant Operation

4.664
Some conceivable types of abnormal events which could conceivably occur at the Lakefront Plant include the following: malfunction of a wastewater treatment plant (e.g., overload of clarifiers, loss of microbial populations in biological systems, failure of neutralization system, leaks or spills from chemical storage areas or modes of transport; and power failure. One of the worst abnormal events with respect to the potential for surface water impacts, would be a complete power failure at the plant resultant effect that untreated wastewater is discharged. Chemicals that would be present at the proposed plant would include a variety of hydrocarbon fuels (gasoline, diesel, fuel, oil, etc.), acids and bases for neutralization of effluents, chlorine, lubricating oils, hydraulic fluids, and certain coke byproducts (e.g., tar and light oil). The applicant has stated that all shipments of oils and other liquid cargos to and from the proposed plant will be made by truck or rail. If so, the proposed action will not lead to increased Lake Erie ship traffic of oils, etc., and the likelihood of spills of such material directly to Lake Erie will not be increased by the proposed action. However, stream watersheds intersected by product shipment routes would be exposed to potential increases in spill exposure. Spills of any hazardous or toxic liquids on or near the proposed site may find their way into Lake Erie. With proper spill isolation and clean-up procedures, it is unlikely that contaminants will reach the lake. However, such events, should they occur would have an adverse impact on the lake. Spilled material is likely to reach the lake via a tributary such as Conneaut Creek or the Turkey Creek watershed.

Material entering the lake via a tributary will, under the prevailing flow conditions, remain in the nearshore area for long periods of time. Malfunctioning of the wastewater treatment system could result in increased concentration of certain chemicals constituents in the main discharge effluent. The change in effluent quality will depend on the type and location of the malfunction. The combining of all wastewaters prior to discharge will serve to reduce the magnitude of variations in effluent quality. Nonetheless, without holding ponds, a malfunction of treatment systems could lead to high contaminant concentrations in the vicinity of the main discharge, a condition which could exist for several days.

Thermal Impacts

4.665
Projected Temperatures of Wastewater Effluent. The applicant estimates the temperature of the combined wastewater effluent from the proposed Lakefront Plant (i.e., cooling tower blowdown and process blowdown) will reach the values given below. These values appear reasonable when compared with other published data; they may, in fact, be conservative (i.e., too high) since the rationale used for their estimation did not take into consideration any cooling that would take place in the final retention (equalization) ponds prior to discharge.

	SUMMER		WINTER	
	Average	Maximum	Average	Maximum
Effluent Temperature, °C	25	33	7	20
Increase over Lake water Temperature, °C	2	10	6	19

4.666
The applicant estimates that the cooling tower blowdown will be 6,680 m^3/hr and the process blowdown, 4,400 m^3/hr, resulting in a total of 11,100 m^3/hr, as the final effluent for discharge to Lake Erie. It is assumed that the various cooling tower blowdowns will be operating under similar conditions and, therefore, have the same effluent temperature. Thus, the same temperature value has been used for all cooling tower blowdown, based on the effluent being 5.5°C above the corresponding wet bulb temperature, but no less than 4°C during the winter. The process blowdown must be subdivided into the major unit operations, i.e., coke plant, sinter plant, blast furnace, steelmaking (BOF), continuous caster, hot strip, and plate mill in order to calculate its average temperatre. There is also other miscellaneous process blowdown indicated (514 m^3/hr) representing service-type flows, such as potable and service water supply treatment discharge, treated sanitary sewage, and various other service-type discharges. In the absence of design data for the various

process treatment systems, effluent temperatures from each of the major process units have been estimated based on the type of treatment that they are expected to receive. For example, where treatment involves a cooling tower, it is estimated that the temperature of the process effluent will be similar to that of other cooling tower blowdown, i.e., 5.5°C above the wet bulb temperature. The thermal effluent from the sinter plant wet electrostatic precipitator is estimated to have a maximum of 54°C in summer and 46°C in winter. Effluent from the basic oxygen furnace (BOF) (i.e., the blowdown from the venturi scrubbers which quench the exit gases) is expected to have a summer temperature of about 73°C. This effluent, after passing through the treatment system, is projected to cool to about 57°C. (4-47) A winter temperature of about 8°C lower is expected.

4.667
For the coke plant, which has biological treatment, USEPA data (4-48) for the effluent from the biological treatment system at the applicant's Clairton Works were used. These data for January 1974, indicate an average temperature of the effluent from the biological treatment system of 30°C with a maximum of 36°C. The same average values were used for winter and summer. A summary of the data is provided in Table 4-311. The process units having a cooling tower as part of the process blowdown are the blast furnace, continuous caster, hot strip mill and plate mill. The sinter plant and BOF utilize a scrubber system. Thus, the blast furnace continuous caster, hot strip, and plate mill, with a combined discharge of 3,119 m^3/hr, have a greater influence than the discharge from the sinter plant and BOF, with a combined discharge of only 550 m^3/hr. Using these assumptions, the calculated temperature of the combined process blowdown was found to average 28°C (maximum 35°C) in the summer and 12°C (maximum 24°C) in the winter. The other miscellaneous effluents (514 m^3/hr) were assumed to have the same temperature as the rest of the process blowdown in the absence of any other information. Table 4-311 shows that the combined effluent (at the discharge port) is expected to have an average summer temperature of 25°C (maximum-33°C) and an average winter temperature of 7°C (maximum 20°C). Assuming a maximum water temperature of Lake Erie in the summer of 23°C and a minimum winter temperature of 1°C (4-49), the increase in the effluent temperature over the natural lake temperature will average 2°C in the summer and 6°C in the winter.

4.668
The applicant has used several mathematical models to predict the behavior and effects of the thermal discharge plume under a range of conditions. Initial effects were predicted by the PLUME Model developed by the USEPA. The most important limitation of this model is that it is not valid after the plume reaches the surface or an intermediate level of neutral buoyancy. Those conditions could occur 30

Table 4- 311

Projected Temperature of Lakefront Plant Wastewater Effluent

Effluent Stream	Flow (m^3/hr)	Temperature (^{o}C) Summer Average	Summer Maximum	Winter Average	Winter Maximum
Cooling Tower Blowdown	6,680	23	31	4	18
Process Blowdown					
a) Coke Plant	237	30	36	30	36
b) Sinter Plant	271	54	54	46	46
c) Blast Furnace	443	23	31	4	18
d) BOF	279	57	57	49	49
e) Continuous Caster	1,042	23	31	4	18
f) Hot Strip and Plate Mill	1,634	23	31	4	18
g) Other	514	28	35	12	24
Subtotal	4,420	28	35	12	24
Combined Effluent	11,100	25	33	7	20
Mean Lake Temperature		23		1	
Increase in Water Temperature		2	10	6	19

Source: Arthur D. Little, Inc. estimates.

to 70 meters from the outfall. Therefore another model, LAKEPLUME, was developed by the applicant's consultant. This model assumes the plume to be a passive entity with a velocity and density similar to the surrounding lake water. This model also assumes that a uniform steady current carries the effluent away from the source and is thus valid only after winds have blown from the same direction for six to twelve hours. (The USEPA has raised some concern about performance of the diffuser under zero flow conditions which are not predictable by LAKEPLUME and is requiring further analysis prior to any approval of an NPDES permit.) The purpose of the modeling has been to estimate typical and extreme conditions within the mixing zone and effluent plume for critical periods in the annual cycle. Biological, limnological, and meteorological considerations indicated that these critical periods are February, early June, late August, and October. The reasons for these choices and a discussion of plume behavior during the respective seasons are given below.

4.669
During February, lake temperatures are colder than during any other month, and the lake is generally, partially or totally covered with ice. The near-shore area is almost invariably ice-covered during February. The ice cover restricts the ability of the wind to generate currents, so water circulation is relatively sluggish. Observations in Lake Erie (near Nanticoke) have shown that current speeds under fast ice are roughly half those observed during ice-free periods. (4-50) The reduced ambient currents are correspondingly less effective in dispersing waste heat and other constituents. Furthermore, the process wastewater temperature increase over ambient temperature is generally greater in the winter than in summer. Typically, the plume temperature will be 6°C above ambient during February, but during warm winter weather the effluent could be as much as 20°C above ambient. The warm plume is initially buoyant and rises toward the surface. When water warmer than 4°C (the effluent) mixes with water colder than 4°C (the ambient lake water), the mixture is likely to be denser than either the effluent or the ambient water because 4°C is the temperature of maximum density of fresh water. However, the density difference between water of 4°C and 0.6°C (ambient) is very small (9.5×10^{-5} gm/cc), compared with the difference in density between the effluent and the ambient water (17.8×10^{-5} gm/cc if the effluent were 10°C; 188.6×10^{-5} gm/cc if the effluent were 21°C). Due to the high velocity characteristic of the submerged diffuser, the very small negative buoyancy of the 4°C mixture is found to have no significant effect on the initial rise of the effluent plume. However, once the plume velocity decreases as a result of mixing, the plume will tend to sink. The result is a plume which rises to the surface within 50-60 meters of the outfall, its speed decreasing as it rises. The surface interaction with the ice cover dissipates some of its momentum and

Table 4- 311

Projected Temperature of Lakefront Plant Wastewater Effluent

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Mean Lake Temperature		23		1	
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Source: Arthur D. Little, Inc. estimates.

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4.669
During February, lake temperatures are colder than during any other month, and the lake is generally, partially or totally covered with ice. The near-shore area is almost invariably ice-covered during February. The ice cover restricts the ability of the wind to generate currents, so water circulation is relatively sluggish. Observations in Lake Erie (near Nanticoke) have shown that current speeds under fast ice are roughly half those observed during ice-free periods. (4-50) The reduced ambient currents are correspondingly less effective in dispersing waste heat and other constituents. Furthermore, the process wastewater temperature increase over ambient temperature is generally greater in the winter than in summer. Typically, the plume temperature will be 6^{o}C above ambient during February, but during warm winter weather the effluent could be as much as 20^{o}C above ambient. The warm plume is initially buoyant and rises toward the surface. When water warmer than 4^{o}C (the effluent) mixes with water colder than 4^{o}C (the ambient lake water), the mixture is likely to be denser than either the effluent or the ambient water because 4^{o}C is the temperature of maximum density of fresh water. However, the density difference between water of 4^{o}C and 0.6^{o}C (ambient) is very small (9.5 X 10^{-5} gm/cc), compared with the difference in density between the effluent and the ambient water (17.8 X 10^{-5} gm/cc if the effluent were 10^{o}C; 188.6 X 10^{-5} gm/cc if the effluent were 21^{o}C). Due to the high velocity characteristic of the submerged diffuser, the very small negative buoyancy of the 4^{o}C mixture is found to have no significant effect on the initial rise of the effluent plume. However, once the plume velocity decreases as a result of mixing, the plume will tend to sink. The result is a plume which rises to the surface within 50-60 meters of the outfall, its speed decreasing as it rises. The surface interaction with the ice cover dissipates some of its momentum and

thereafter there is a significant cooling through the melting of ice at the surface such that bottom temperatures are higher than the surface temperature at moderate distances (approximately 1 km) from the outfall. However, a fast surface ice cover will not be melted through by the plume. Initial freeze-up in early winter may be slightly delayed because of the heated plume, and likewise spring thaw may be hastened slightly, but atmospheric and solar influence on the ice cover will predominate over waste heat effects.

4.670
Early June is a critical month because of the occurrence of finfish spawning activity in the near-shore area. Also May and early June is the only period when the near-shore area exhibits significant thermal stratification. It is expected that thermal stratification in the shallow open waters near the southern shore of the lake will be infrequent and shortlived; occurring only when solar heating is strong and wind mixing is negligible. Temperature measurements in 1977 tend to indicate that this is the case although surveys were too infrequent to adequately characterize the duration of stratified conditions. In June, the effluent temperature is typically 12°C above ambient but could reach as high as 19°C above ambient during warm weather. The plume will generally possess sufficient buoyancy to break through the ambient stratification and rise to the surface. A combination of moderate ambient thermal stratification (0.2°C/m) and low effluent buoyancy (T 10°C) can result in a trapped plume at mid-depth. Such a combination would be uncommon (estimated recurrence interval: less than once per year) because strong stratification is generally accompanied by warm air, while low effluent buoyancy can only occur, under normal operations, with low air temperatures. Nonetheless, the environmental significance of this event, though rare, should not be overlooked since a trapped plume could lead to contaminated bottom water during spawning season. Typically, the June plume will rise and spread at the surface within 30-50 meters from the source. The surface area affected by the plume will increase substantially during stagnant conditions. A surface plume is also very susceptible to wind action and would be pushed toward the shore under onshore winds. The surface spreading proceeds with little additional dilution beyond that achieved as a result of the diffuser, especially with light to moderate winds. (4-54) Thus, the "worst case" conditions at the shore would occur when there was a surface plume and light onshore winds.

4.671
Late August was chosen as a critical period because ambient temperatures are maximum at that time and significant increases could led to fish mortality. The effluent would typically be 2°C warmer than the lake water, but could be as high as 10°C above ambient. During August, the buoyant plume would invariably rise and spread at

the surface within 45-65 meters of the source with effects similar to those discussed for June. October is another period of inshore finfish activity and a period of intense limnological activity associated with the autumn turnover of the lake water. Effluent temperature would typically be 8°C above ambient, but could reach 17°C above ambient. The plume would invariably rise and spread at the surface with effects similar to those described for June. The plume reaches the surface above 40-60 meters from the outfall. All of the cases simulated by computer modeling are listed in Table 4-489 along with the important environmental parameters associated with each case. The effluent temperatures used in the modeling are conservative, i.e., they are slightly higher (by 2-1°C) than what is actually expected. Plots of isotherms (lines of constant temperature) for the various seasons and at several depths are shown in Figures 4-81 through 4-101. Case numbers refer to those shown on Table 4-312. Ohio State standards for temperature increase at the edge of the mixing zone are met for all cases considered. The maximum mixing zone temperature increase of 1.3°C (2.3°F) occurs in case 3-1 during June when high effluent temperature and low current speeds are encountered. The State standard for temperature increase is 1.7°C (3°F). Ohio State standards for absolute temperature (ambient plus increment) are also projected to be met with considerable margin of safety.

Temperature Effects

4.672
The results of the modeling of thermal effluents is illustrated graphically in Figures 4-81 through 4-101. The environmental characteristics of each of the cases is given in Table 4-312. The plots show contours of the increase of temperature over the ambient temperature in degrees Celsius. Figures 4-81 and 4-82 show the plume structure at mid-depth for a warm day in February with low and high speed ambient currents, respectively. The temperature is uniform with depth for cases 1-1, 1-2, 2-1, and 2-2, so only one plot at mid-depth is shown here. Figures 4-83 and 4-84 represent typical February conditions for low and high-speed ambient currents. Figures 4-85 through 4-87 show plume isotherms for a warm day in early June with stagnant lake current conditions. This is the worst case for temperature increase over ambient, reaching 1.3°C near the source and 1.0°C at 900 m from the source. At mid-depth the maximum temperature increase is 0.55°C, and bottom temperatures are raised as much as 0.1°C 5 kilometers from the outfall. Figure 4-88 shows the surface isotherms for high-speed lake currents with all other conditions identical to those in Figure 4-85. The plume is not as broad as in Figure 4-89 for low-speed lake currents, nor is the maximum temperature increment, 1.0°C, as large as the stagnant case. The temperature increase at mid-depth and bottom are quite small for case

Table 4- 312

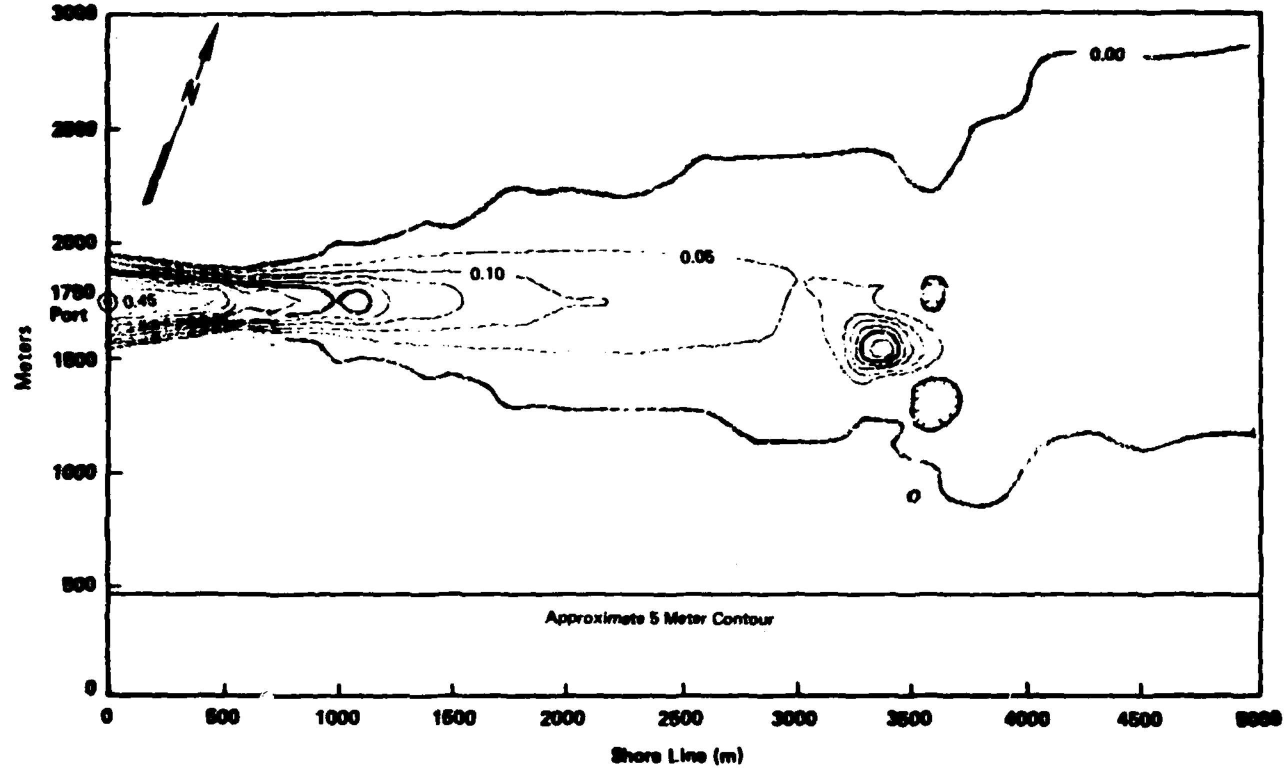
Environmental Characteristics of Cases Studied by Computer Modeling

	Month	Ambient Lake Temperature (°C)	Discharge Flowrate (thousands gpm)	Depth (meter)	Distance Offshore (meters)	Effluent Temperature (°C)	Ambient Lake Current Speed (cm/sec)
1-1	February	0.6	45	10	1750	21.1	1.5
-2						21.1	30.0
2-1						9.0	1.5
-2						9.0	30.0
3-1	June	13.3-13.6	45	10	1750	32.6	1.5
-2						32.6	45.0
4-1						25.3	1.5
-2						25.3	45.0
5-1	August	24.3	45	10	1750	32.3	1.5
-2						32.3	45.0
6-1						27.3	1.5
-2						27.3	45.0
7-1	October	14.1	45	10	1750	30.6	1.5
-2						30.6	45.0
8-1						22.2	1.5
-2						22.2	45.0

Even-numbered cases (2-x, 4-x, 6-x, 8-x) represent seasonally typical effluent temperatures.

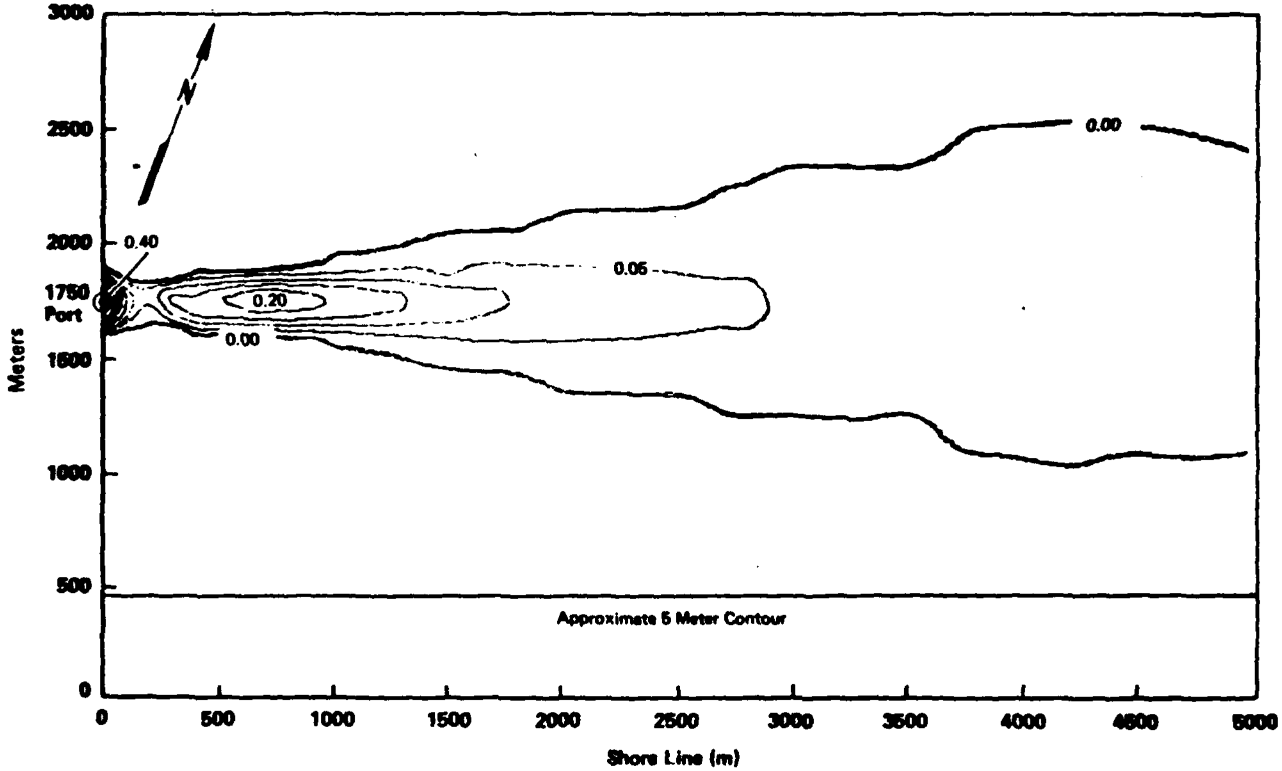
Odd-numbered cases (1-x, 3-x, 5-x, 7-x) represent effluent temperatures expected for a very warm day for that season.

Source: Arthur D. Little, Inc.



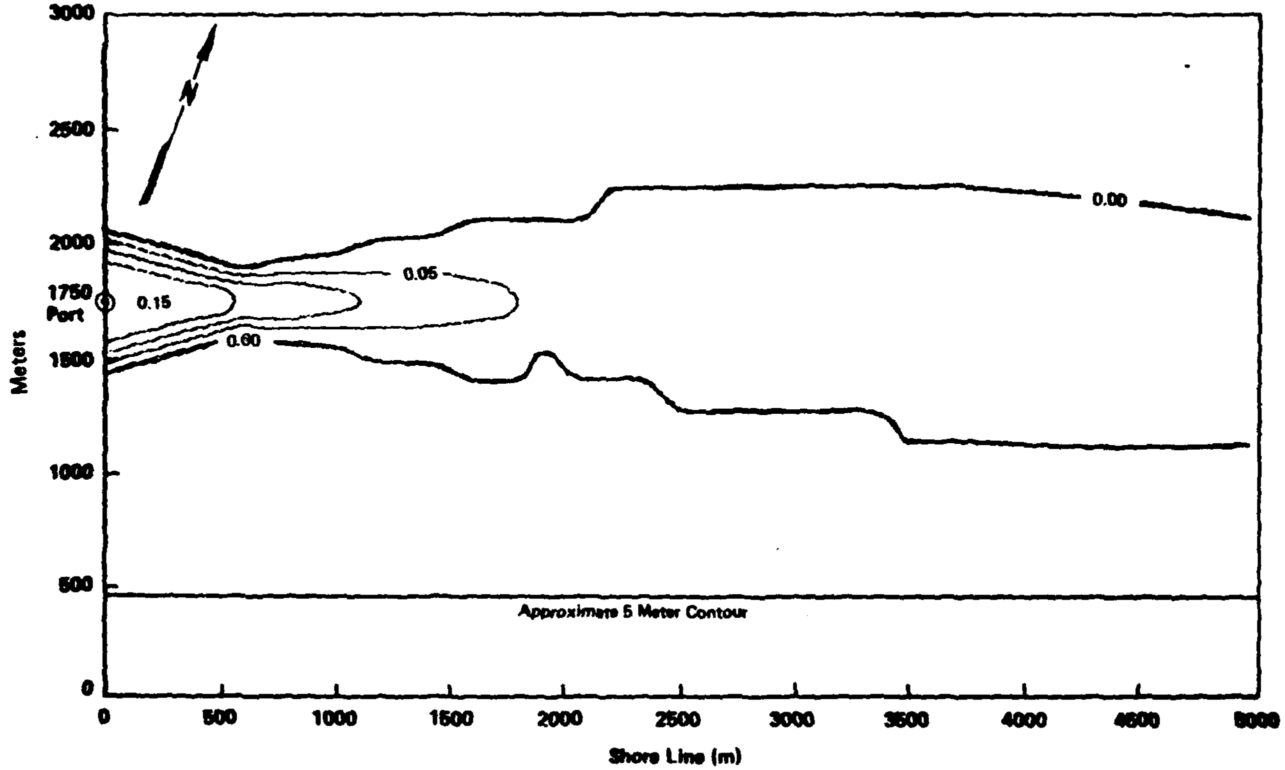
Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4- 31 THERMAL EFFLUENT MODELING RESULTS – CASE NO. 1–1 (5 METERS BELOW SURFACE)



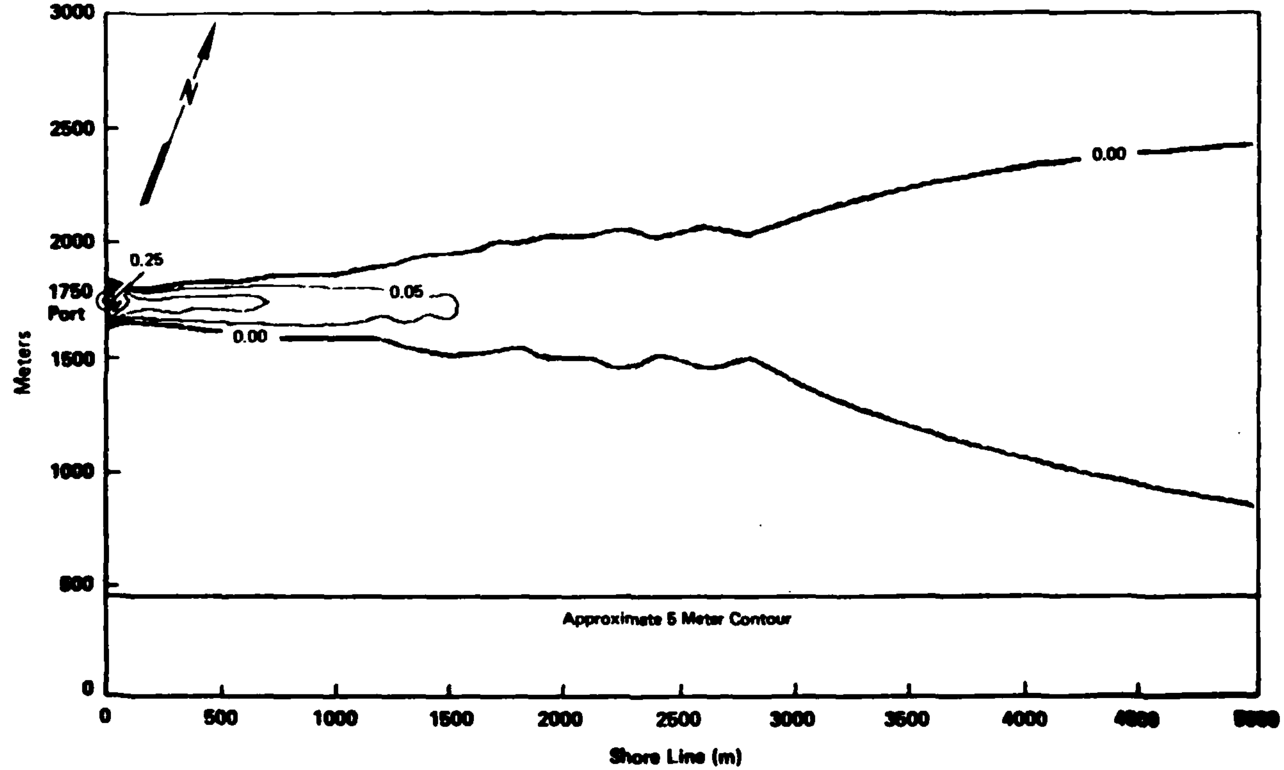
Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4– 82 CASE NO. 1–2 (5 METERS BELOW SURFACE)



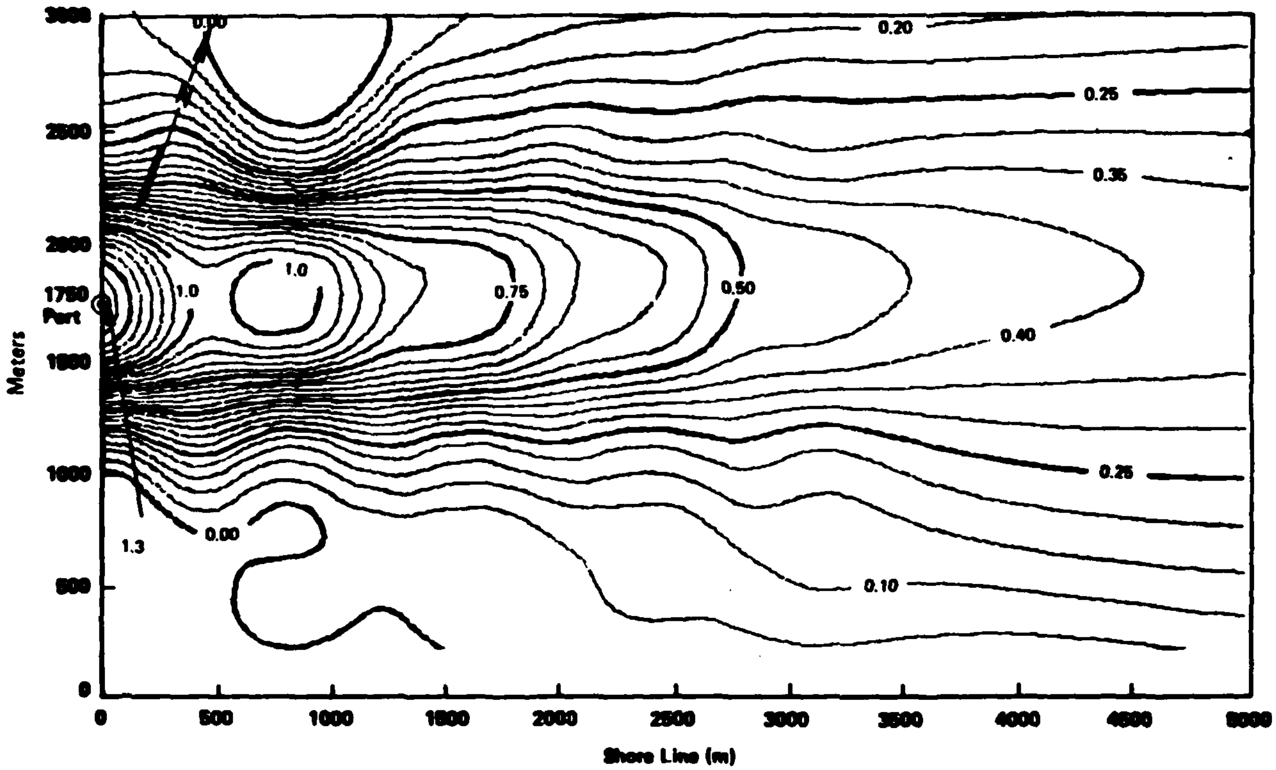
Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4– 83 CASE NO. 2–1 (5 METERS BELOW SURFACE)



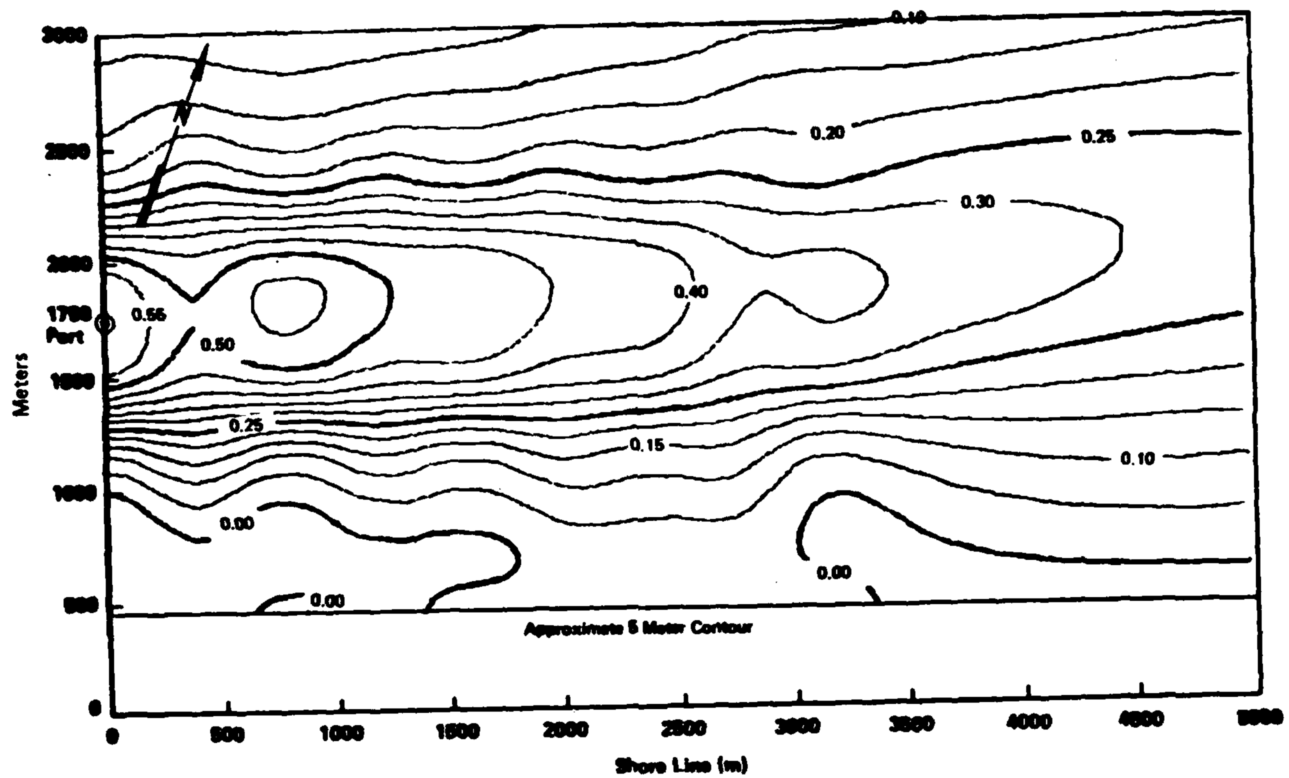
Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4– 34 CASE NO. 2–2 (5 METERS BELOW SURFACE)



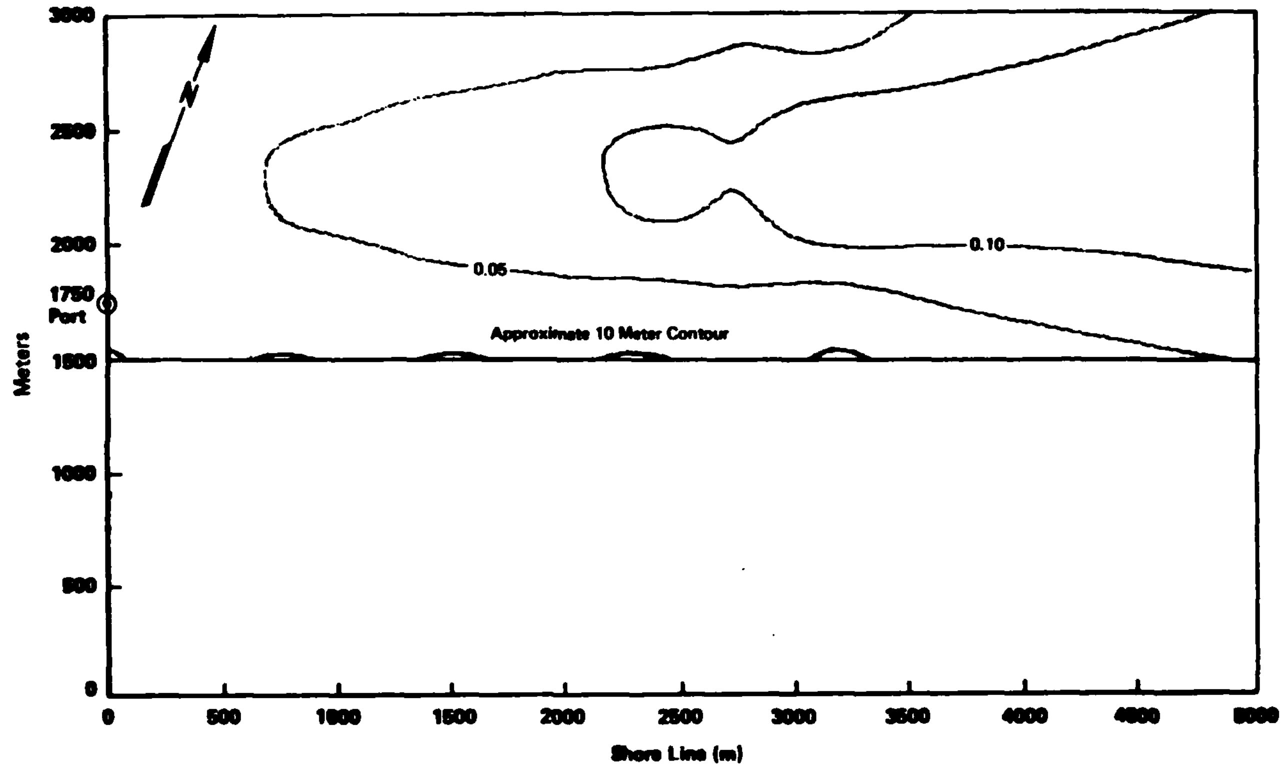
Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4– 35 CASE NO. 3–1 (SURFACE)



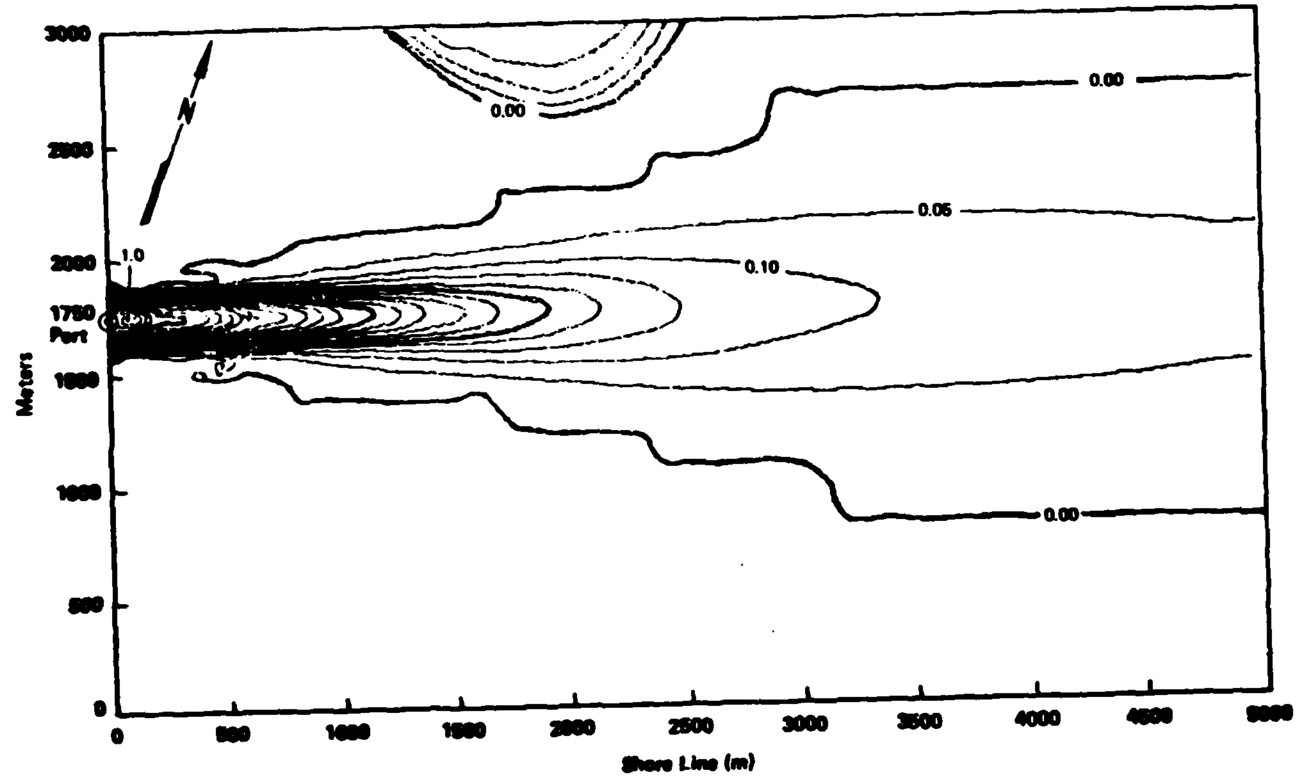
Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4- 86 CASE NO. 3–1 (5 METERS BELOW SURFACE)



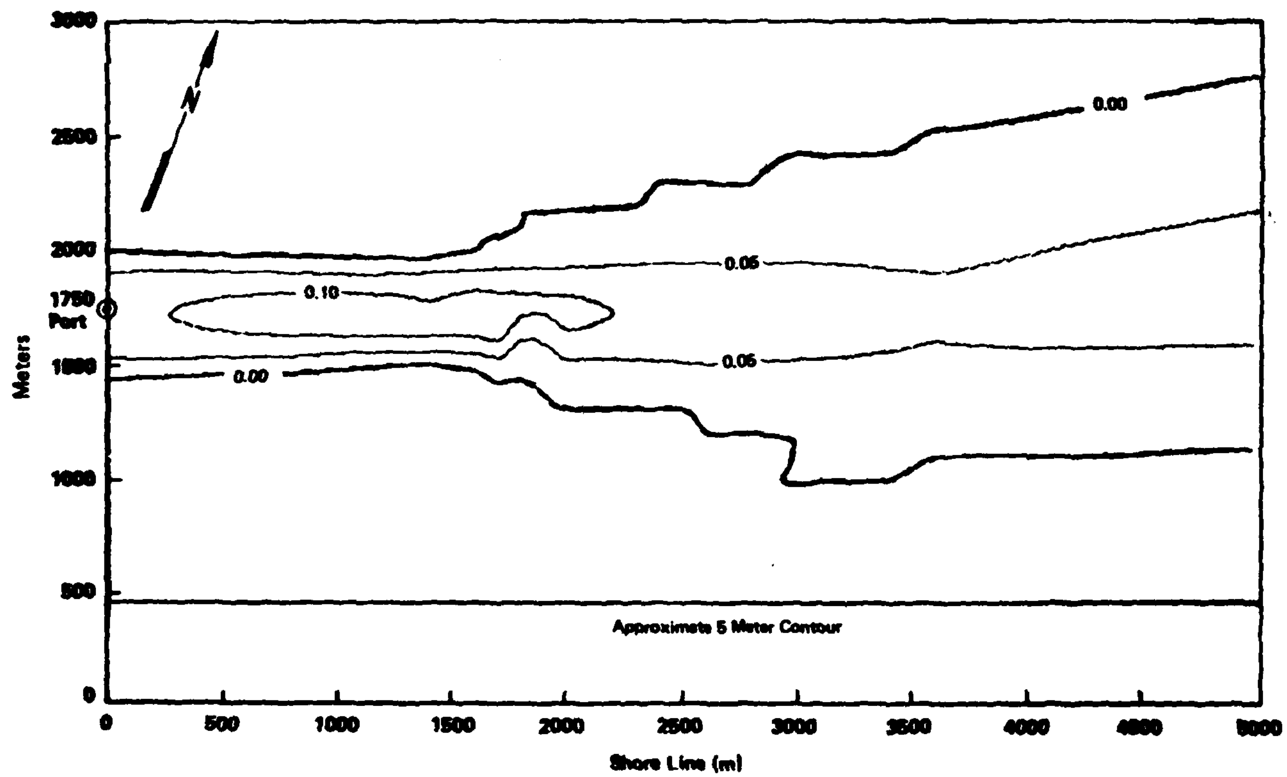
Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4– 87 CASE NO. 3–1 (10 METERS BELOW SURFACE)



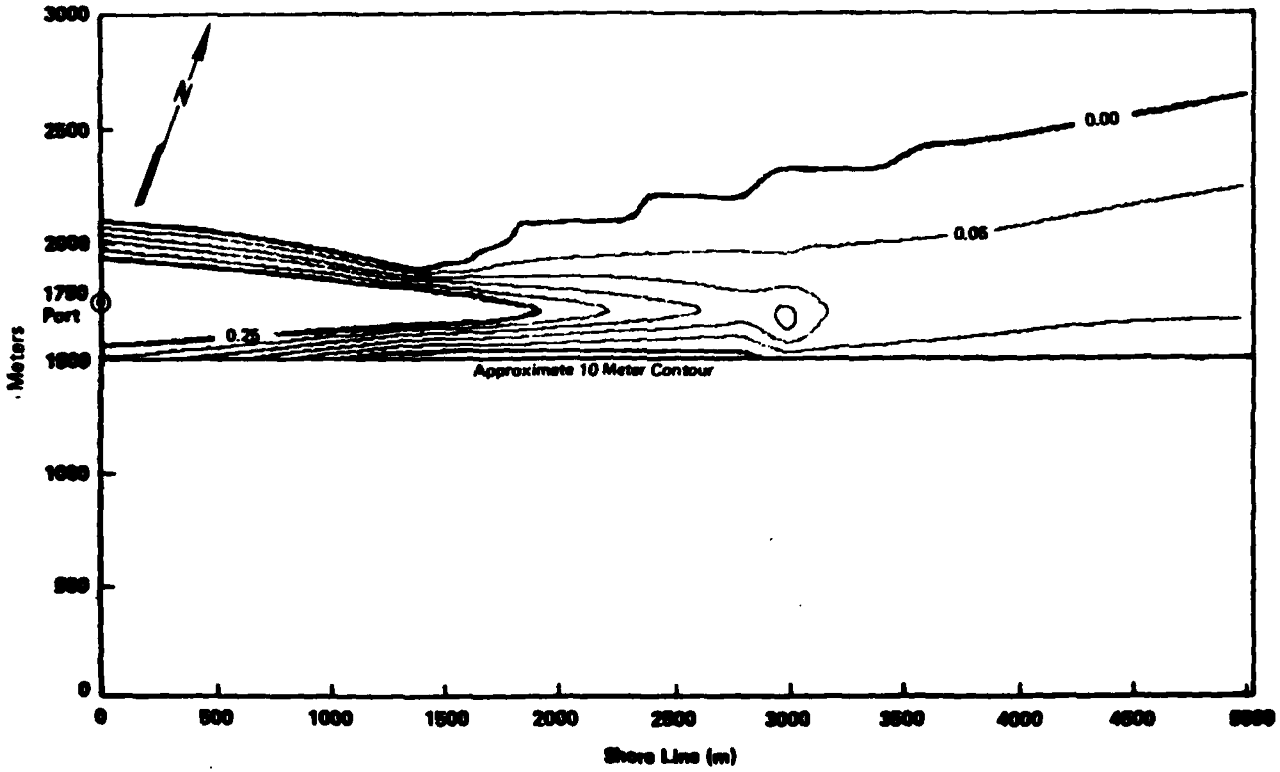
Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4– 83 CASE NO. 3–2 (SURFACE)



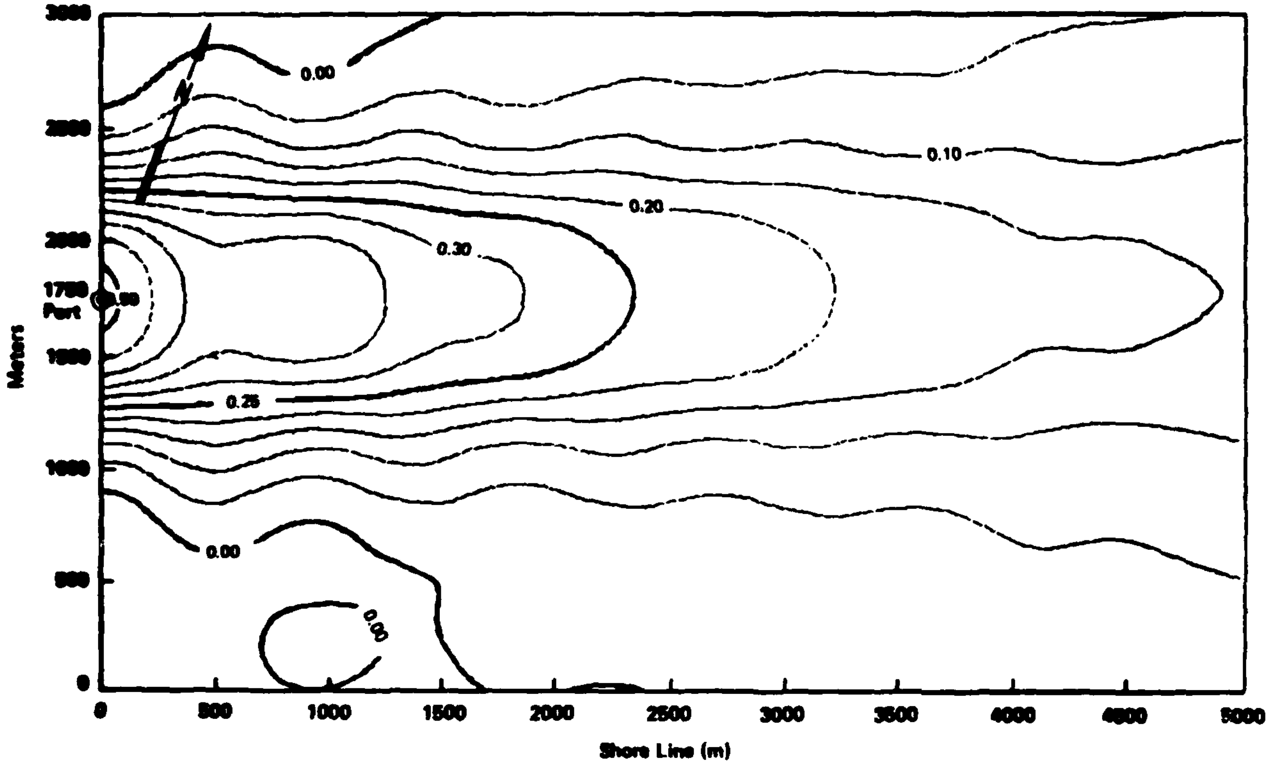
Source: Lake Plume Model based on Arthur D. Little *Inc.*, and United States Steel Corporation estimates (see text).

FIGURE 4– 89 CASE NO. 4–1 (5 METERS BELOW SURFACE)



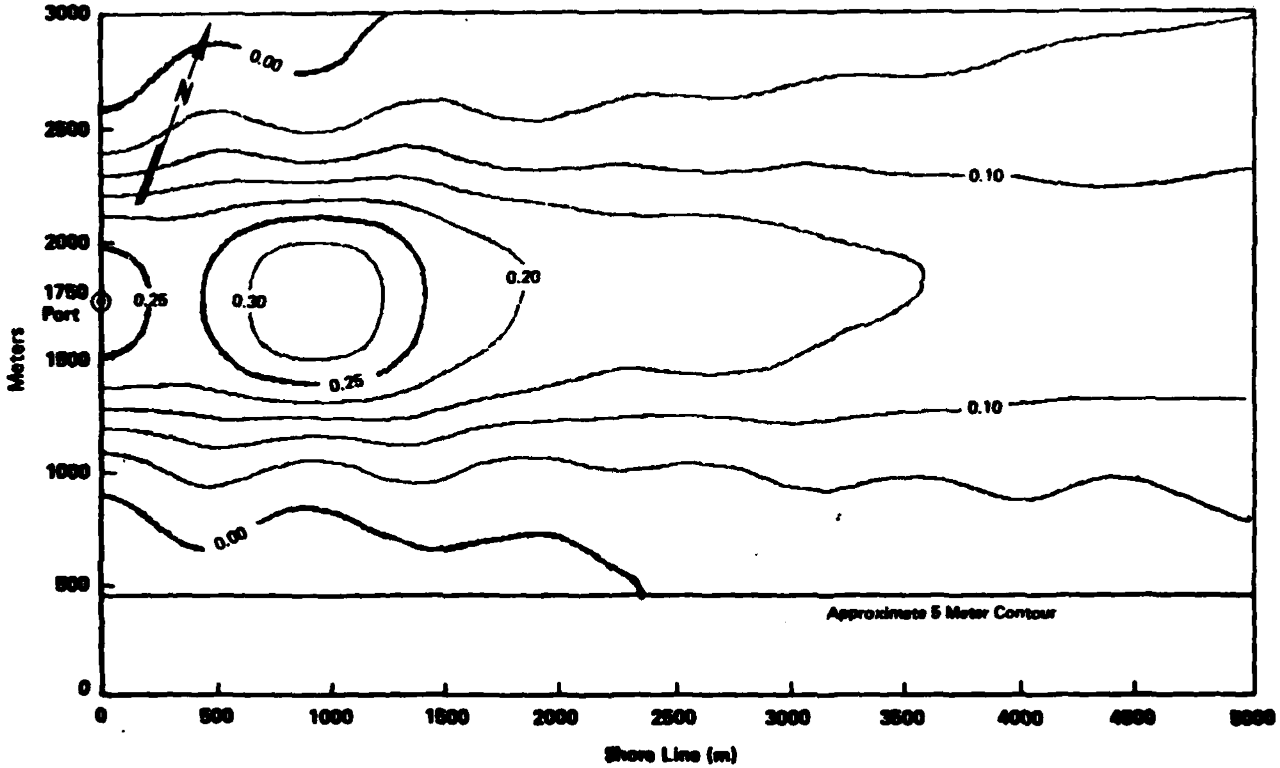
Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4– nn CASE NO. 4–1 (10 METERS BELOW SURFACE)



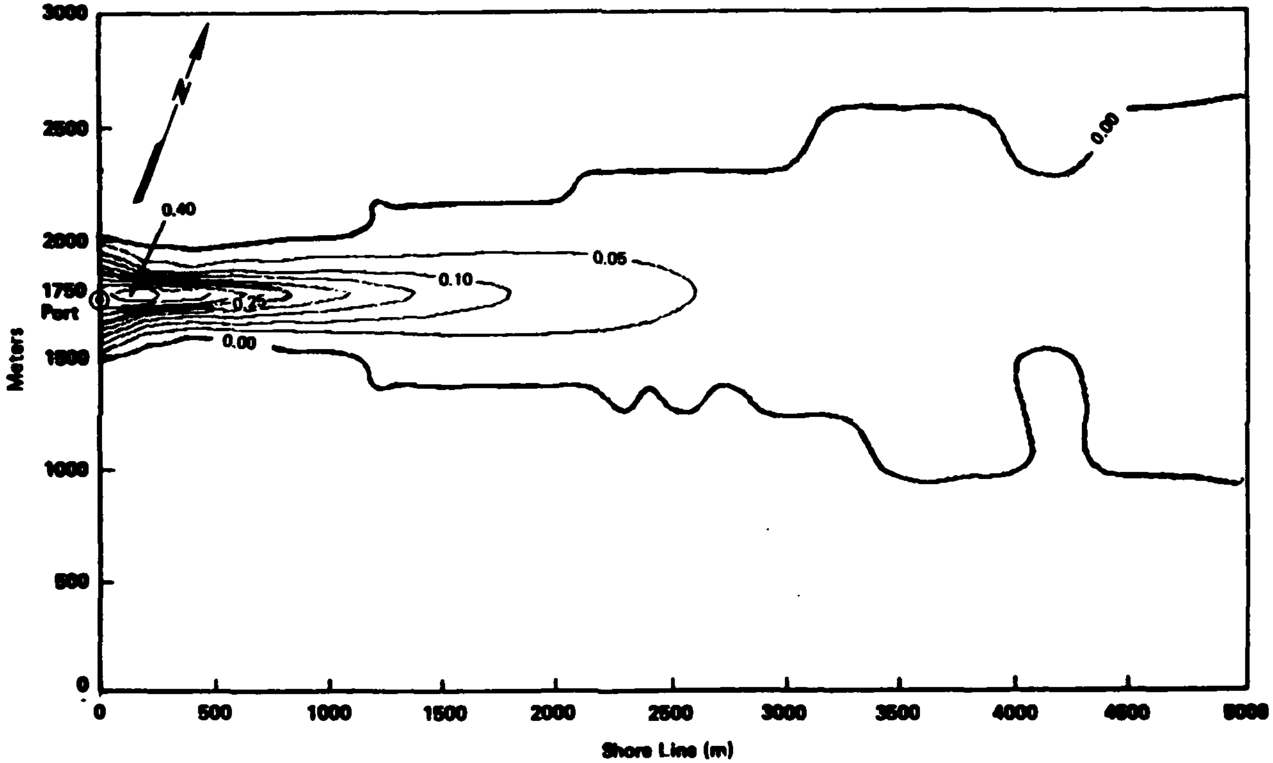
Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4–91 CASE NO. 5–1 (SURFACE)



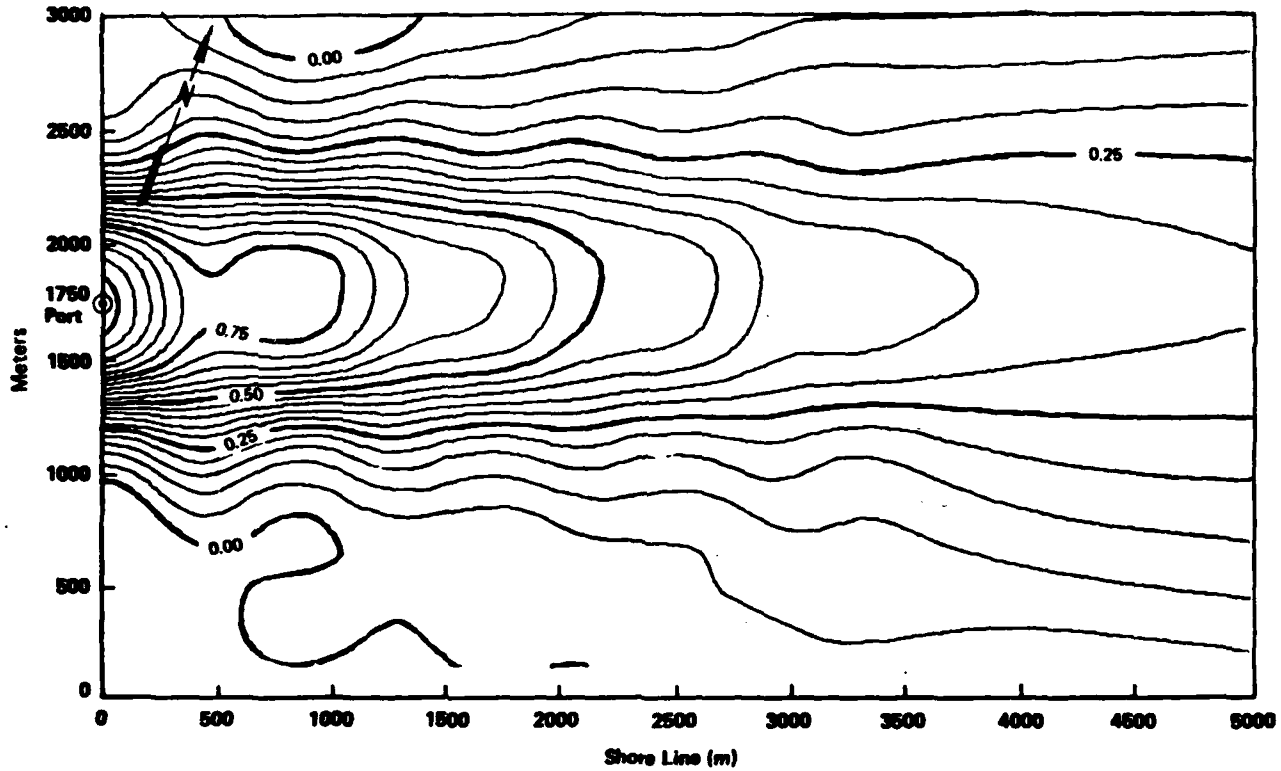
Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4-[illegible]2 CASE NO. 5–1 (5 METERS BELOW SURFACE)



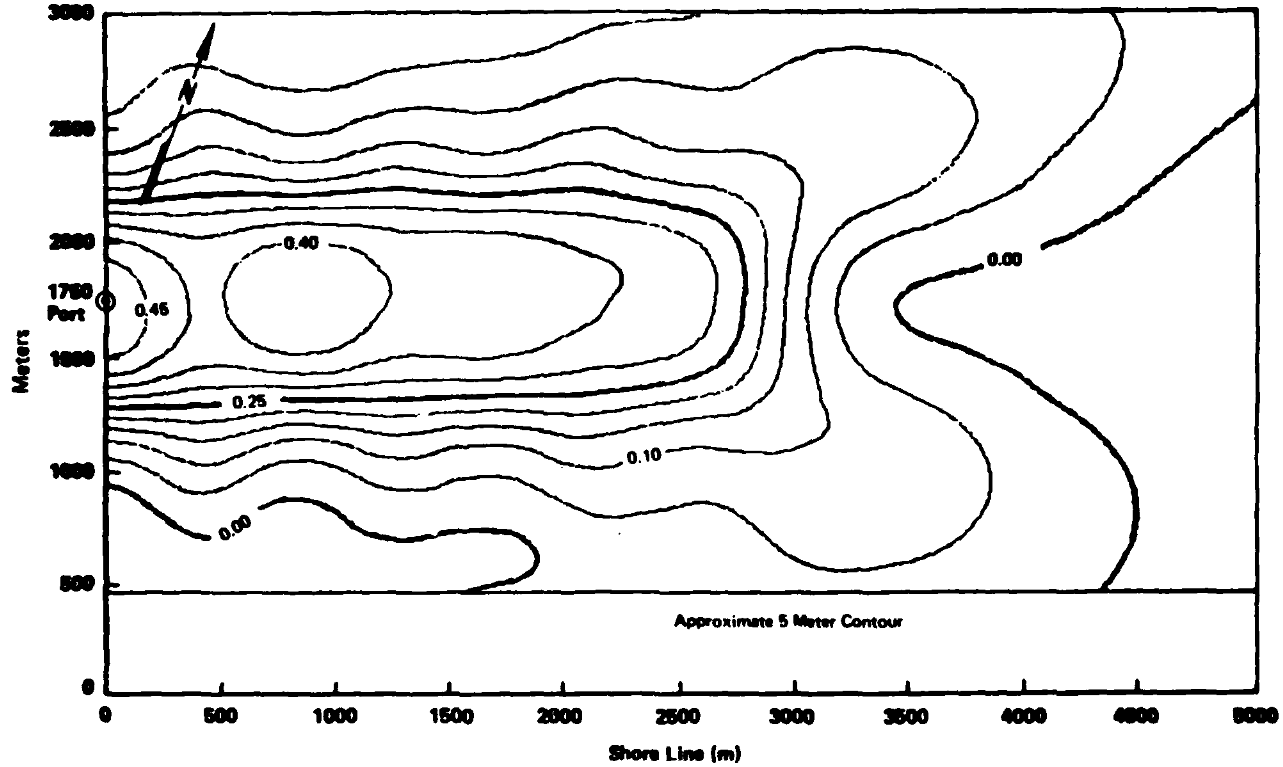
Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4– 93 CASE NO. 5–2 (SURFACE)



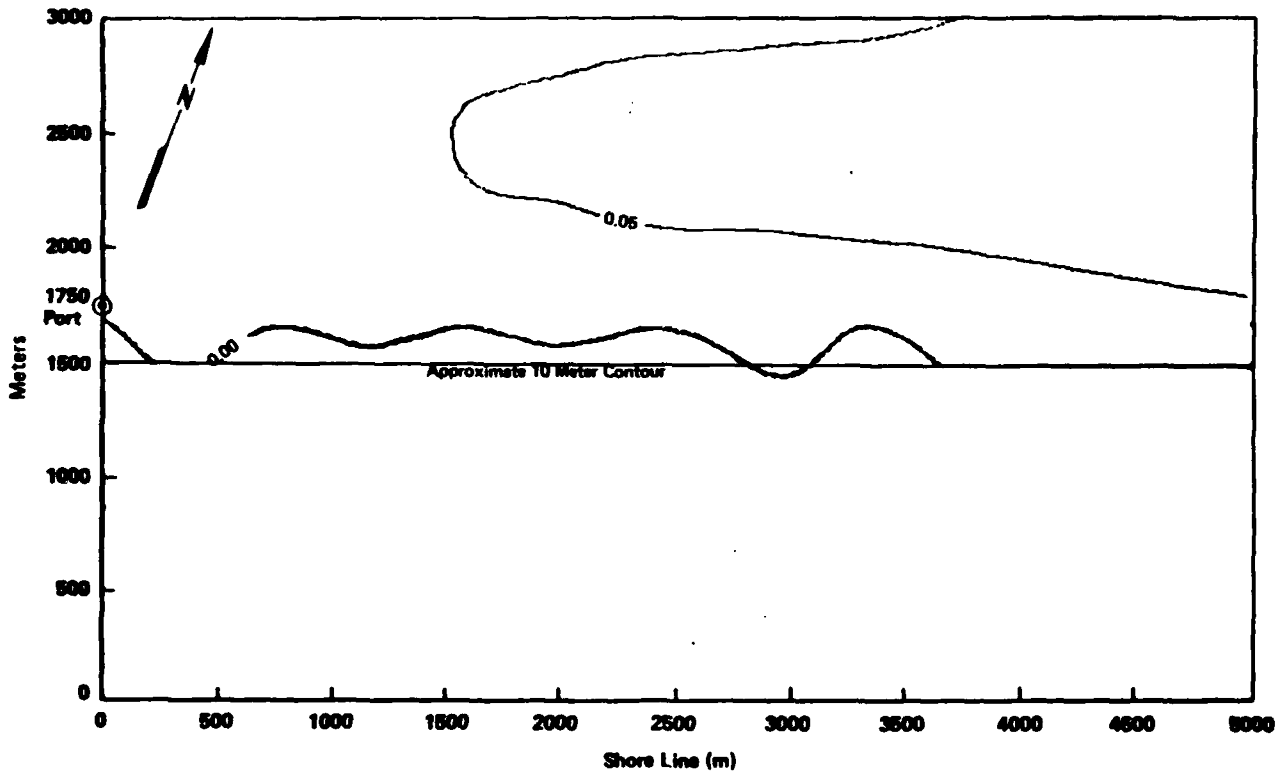
Source: *Lake Plume Model based on* Arthur D. Little, *Inc., and United States Steel Corporation estimates (see text).*

FIGURE 4– 94 CASE NO. 7–1 (SURFACE)



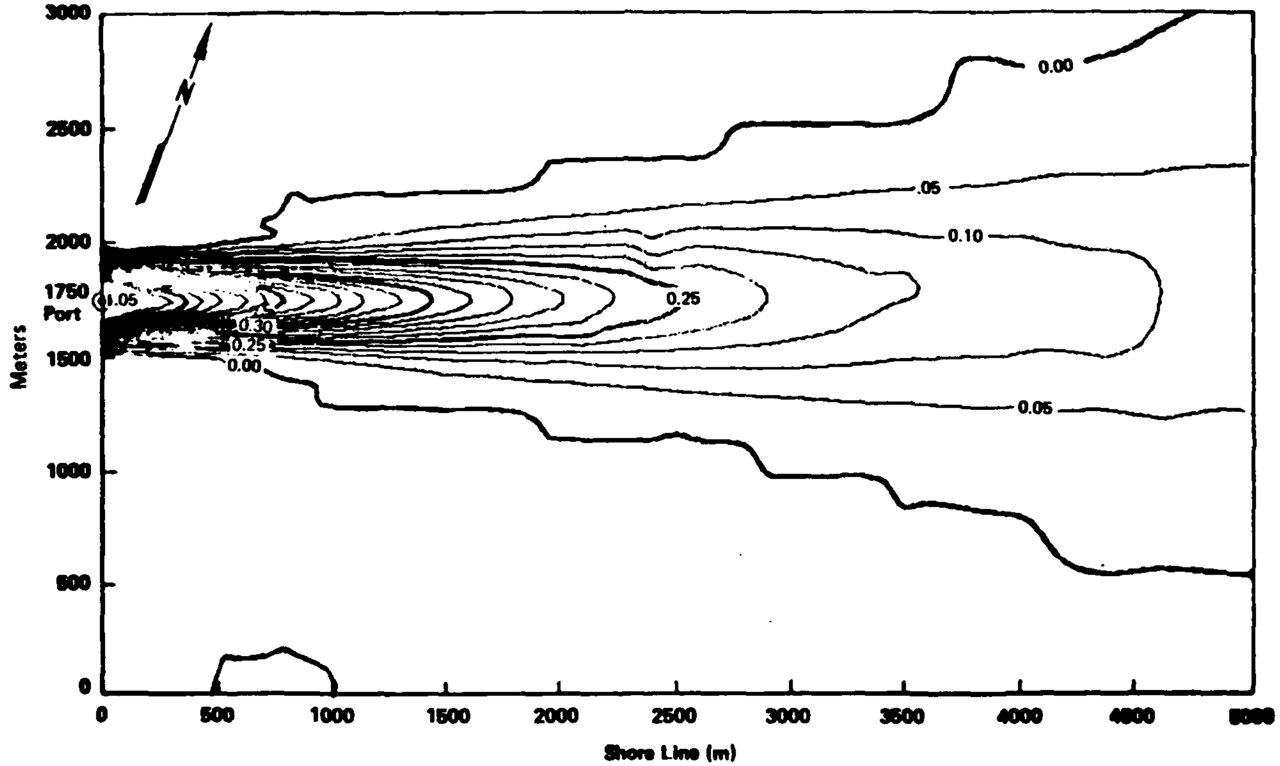
Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4– 95 CASE NO. 7–1 (5 METERS BELOW SURFACE)



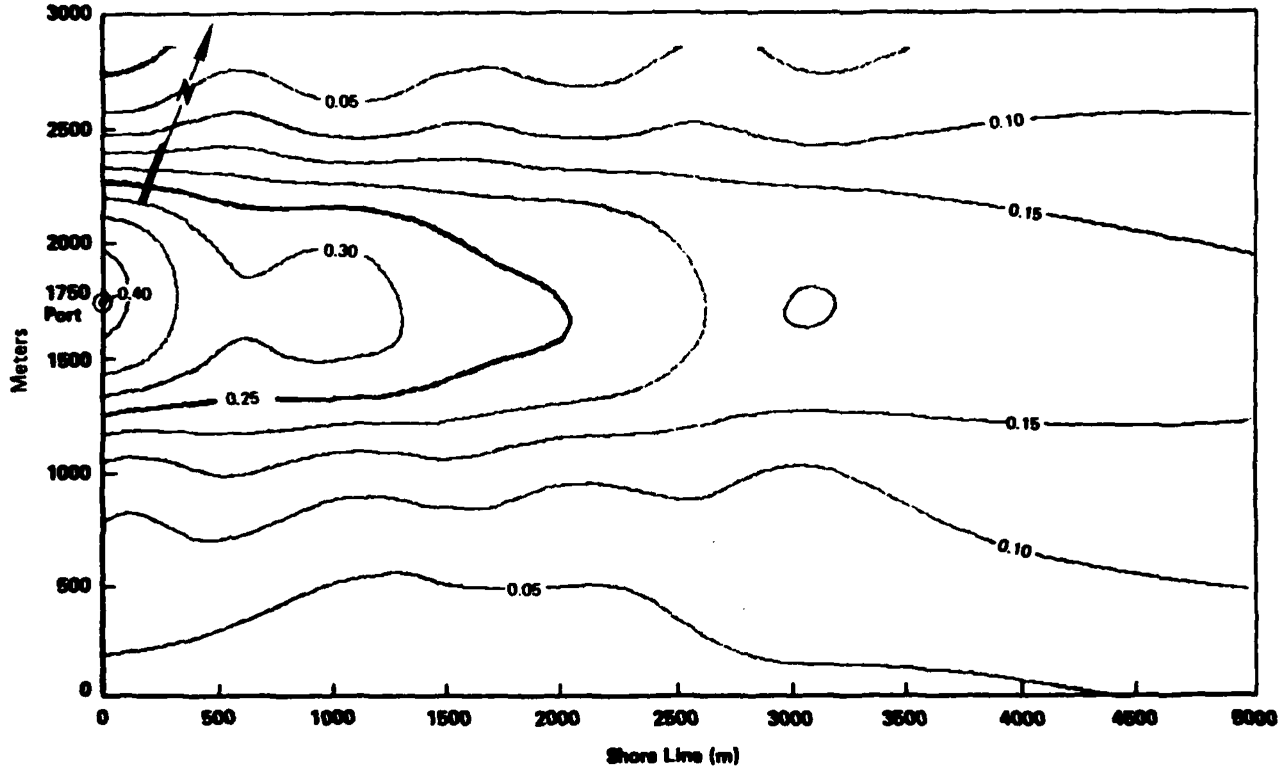
Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4– 96 CASE NO. 7–1 (10 METERS BELOW SURFACE)



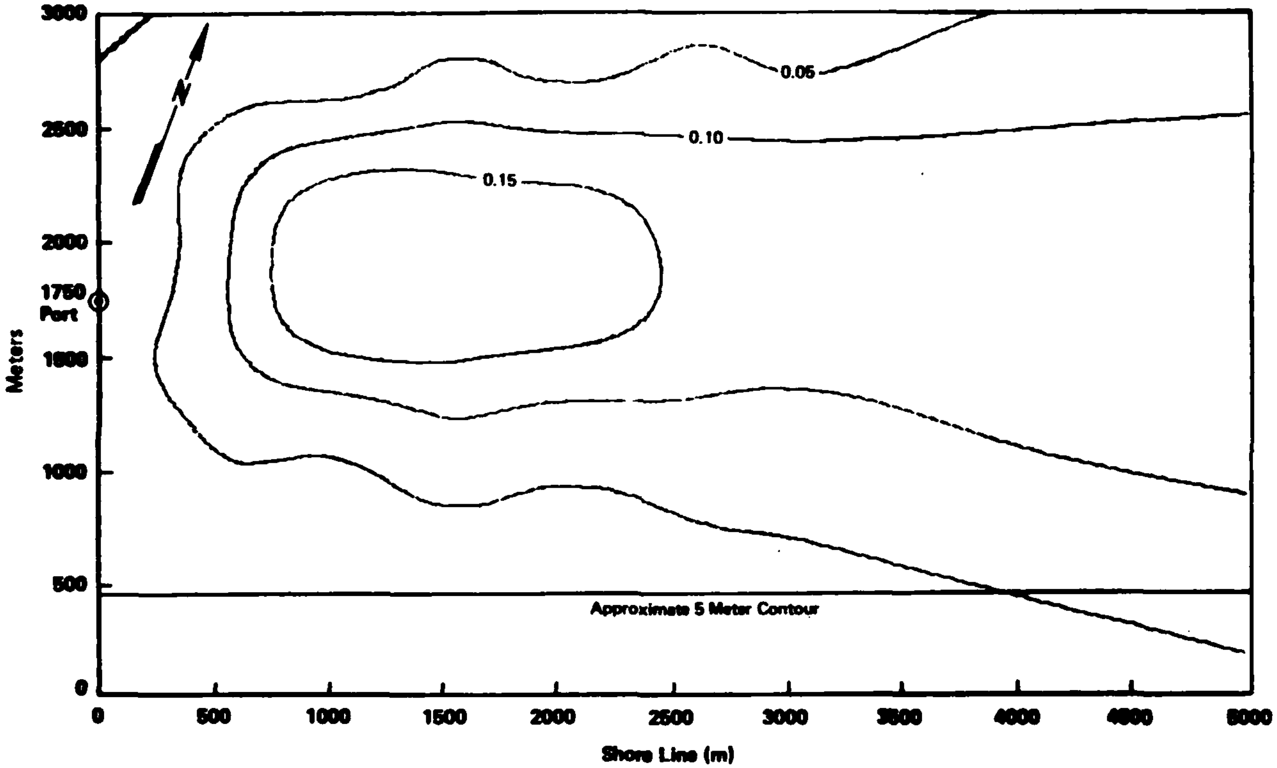
Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation, estimates (see text).

FIGURE 4– 97 CASE NO. 7–2 (SURFACE)



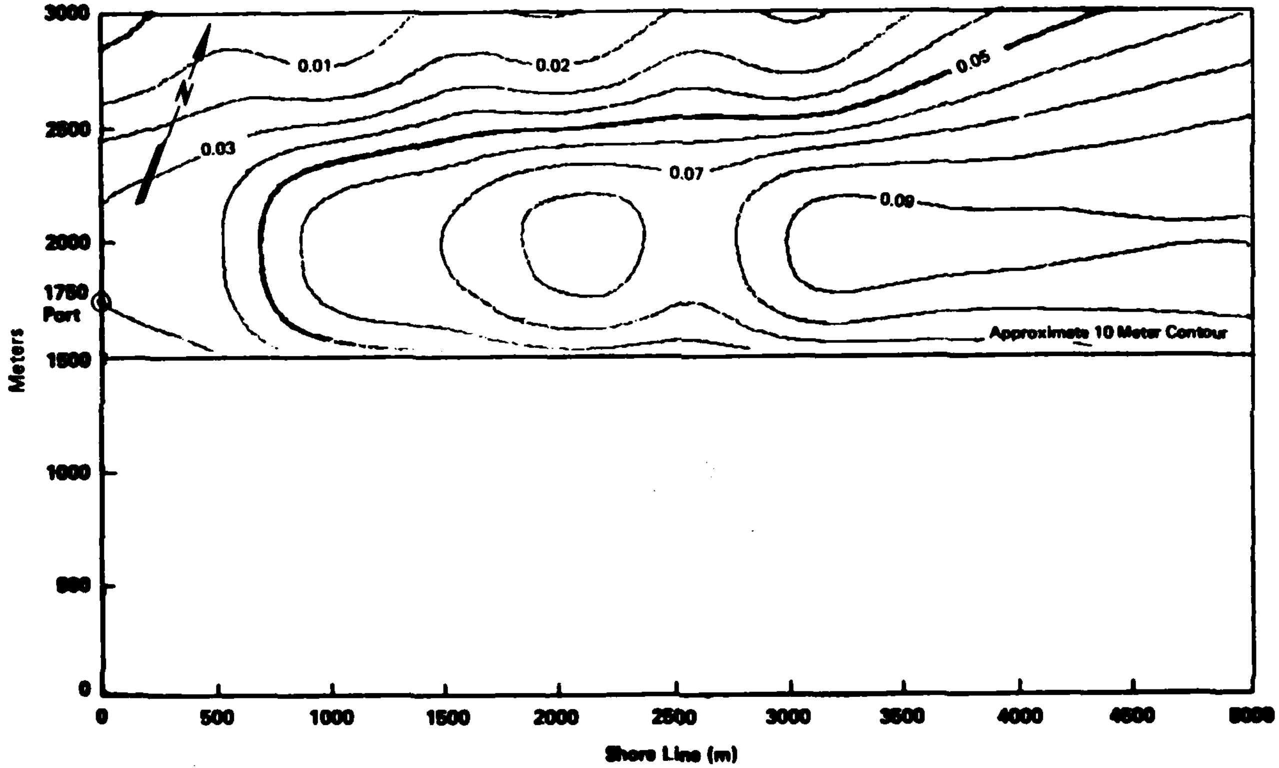
Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4– ?? CASE NO. 8–1 (SURFACE)



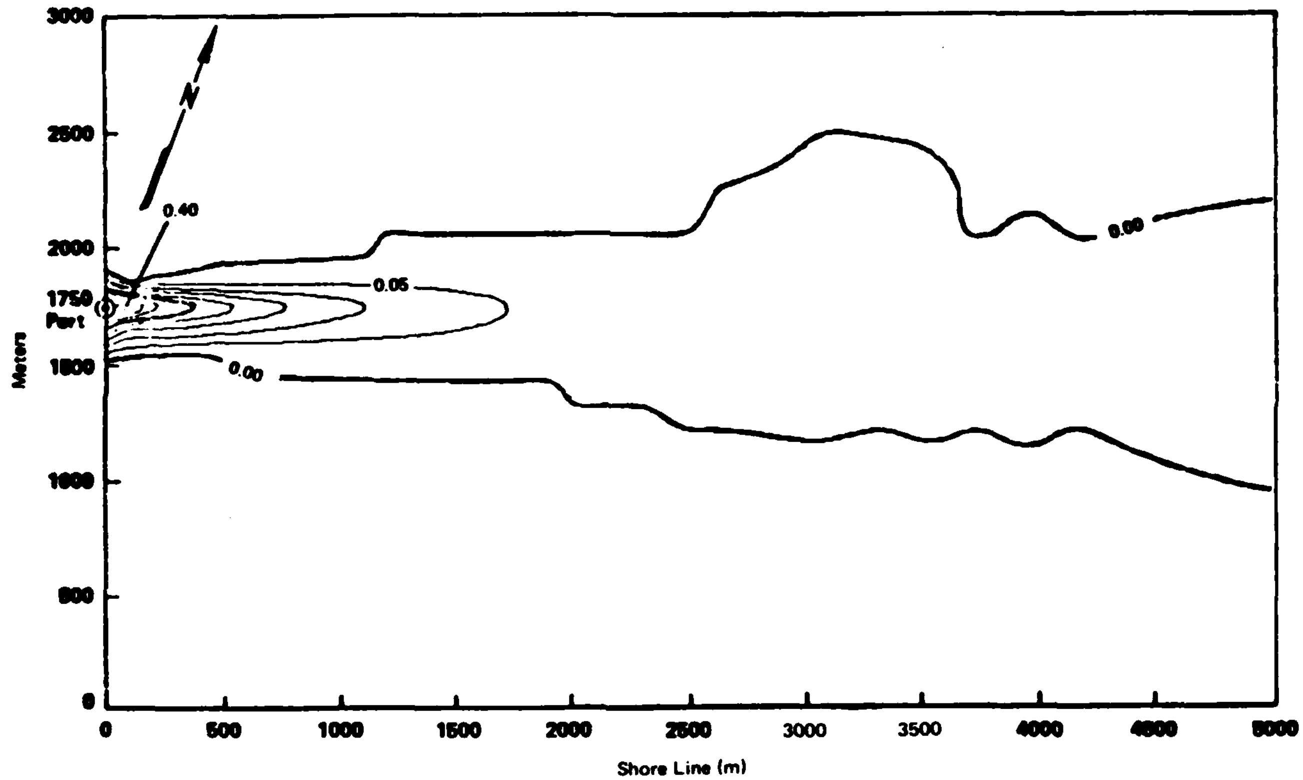
Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel estimates (see text).

FIGURE 4– 99 CASE NO. 8–1 (5 METERS BELOW SURFACE)



Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporatio.. estimates (see text).

FIGURE 4– 100 CASE NO. 8–1 (10 METERS BELOW SURFACE)



Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4– 101 CASE NO. 8–2 (SURFACE)

3-2. Figures 4-89 and 4-90 show plume isotherms at mid-depth and bottom for typical June conditions, in which an ambient stratification of 0.05°C/m prevents the plume from rising and floating on the surface. Instead, it is well mixed from top to bottom and the temperature increase vs. ambient at the surface is negligible. The increase over ambient is greatest at the bottom reaching 0.25°C. The typical high speed case, 4-2, exhibits behavior very similar to that shown in Figures 4-89 and 4-90 and is not shown here.

4.673
On a warm day in August with stagnant lake currents, the plume isotherms are predicted to exhibit a pattern similar to Figures 4-91 and 4-92 at surface and mid-depth. Bottom temperature changes are quite small (maximum 0.1°C). For conditions identical to Figure 4-91, but with brisk lake currents, Figure 4-93, indicates a more narrow plume and a slightly lower maximum temperature increase. Temperatures changes at mid-depth and bottom are quite small for this case. During typical August conditions, the temperature changes at all depths are found to be very small, never exceeding 0.1°C. Figures 4-94 through 4-96 show temperature conditions at the surface, five meters, and the bottom for a very warm day in October with stagnant lake currents. Figure 4-97 shows the analogous high current speed case. This also has a broad plume with a tendency for spreading to shore when lake currents are stagnant. Case 7-2 exhibits negligible bottom temperature changes. Figures 4-98 and 4-99 show thermal conditions predicted for typical October conditions. Within the mixing zone, it is estimated that current speeds induced by the diffuser flow will be reduced.

Impacts of Net Water Withdrawal on Great Lakes Levels

4.674
Consumptive use of water at the proposed plant is expected to be 3,700 m^3/hr which is attributable to cooling tower drift and evaporation losses. This water is released to the atmosphere and in part may subsequently return to the Great Lakes basin through rainfall or decreased evaporation downwind. If all of this water were lost from the Great Lakes basin the effect on the level of Lake Erie would be a reduction of 0.06 cm (0.02-inch) which is insignificant. The International Joint Commission estimates that the consumptive use of water in the Great Lakes basin will increase by 3,720 cfs by the year 2000. (4-108) The proposed plant use represents one percent of this expected increase.

Impacts on Inland Waters

4.675
The impacts on the water quality of inland waters, as a result of operations at the proposed plant, would be primarily due to runoff.

Runoff from the plant property (excluding roofed areas) and raw material storage area would be directed mostly to Lake Erie. However, as a result of the current proposal not to divert Turkey Creek to Conneaut Creek, the stormwater surface runoff discharge patterns discussed in the Draft EIS will change. Most of the stormwater runoff from developed plant areas will be diverted to Lake Erie rather than to Conneaut Creek as originally proposed. Discharge through the main outfall is an option being considered, although possible overflows during peak storms may rule out this plan. Undeveloped areas in the Turkey Creek drainage would flow undisturbed to the creek. It has been assumed that the discharges will be as shown in Table 4-313.

4.676
Prior to discharge, surface runoff from developed areas would pass through sedimentation basins. Flows from any source not meeting the proposed EPA New Source Performance Standards for suspended solids and pH in miscellaneous runoff from iron and steel facilities (29 March 1976) would be treated to meet those requirements. Monitoring and treatment of runoff discharges for other parameters would also be provided as necessary to meet any as yet unspecified regulatory requirements.

4.677
The quality of runoff water would contain slightly elevated levels of suspended solids as indicated on Table 4-314, and would be high in heavy metals and trace elements with a pH range of 6-9. Worst effects on receiving waters would occur during periods following a heavy rainfall. After a rainfall, there may be a first-flush effect (i.e., abnormally high levels of many constituents in the early part of a rain storm) that could have a noticeable effect on the water quality, but for a relatively short period of time, i.e., a few hours. Field observations indicate that almost all of the dissolved materials in runoff from raw materials storage piles are in this first-flush, and following this, only relatively minor concentrations of constituents in the flow are reported. The impacts of this first-flush may be substantially reduced by the use of impoundments for the equalization of runoff waters. These impoundments will be designed to hold a volume of water expected during a 2.5-inch rainfall over 24 hours for a specified drainage area. This is the largest rainfall (in 24 hours) expected over a two-year period.

4.678
Runoff flowing directly into Conneaut Creek from the raw materials storage area would constitute, on average (annual basis), less than 0.1 percent of the flow in the Creek (6.8 m^3/sec). In dry weather, the impacts of this runoff on the water quality in the last two kilometers of Conneaut Creek is likely to be small. A first-flush effect

Table 4- 313
Likely Receiving Waters for Runoff from the Proposed Plant

Receiving Stream	Source of Runoff	Runoff Treatment	Estimated Flows 2.5-In. Rain/Annual Over 24 Hrs/Average (m^3/hr)	Principal Constituents of Interest*
Conneaut Creek	Coal blending area	Gravity settling and, if necessary, lime and polymer addition	540/21	TSS, DS, Fe, trace metals, acidity sulfates
Lake Erie	Blast furnace slag processing area	Impoundment	320/12	TSS, DS. Fe, oil and grease, trace metals
Lake Erie	Q-BOP waste disposal areas	Impoundment with leachate treatment if required	95/4	TSS, DS, Fe, trace metals
Lake Erie	Lined waste disposal areas	Impoundment with leachate treatment if required	1,600/63	TSS, DS, others (depending on types of waste)
Lake Erie/ Conneaut Creek	Other plant areas (developed - excluding roof runoff)	Gravity settling and, if necessary, lime and polymer addition	1,500/57	TSS, DS, Fe, oil and grease, trace metals
Conneaut Creek	New Raw Materials Storage Area	Gravity settling and, if necessary, lime and polymer addition	560/22	TSS, DS, Fe, oil and grease, trace metals
Lake Erie	Oil storage area	Impoundments	55/2	Oil and grease
Lake Erie	Developed plant areas excluding roof runoff	Gravity settling and, if necessary, lime and polymer	2,400/95	TSS, SS, Fe, oil and grease, trace metals
Lake Erie (via main outfall)	Roofed areas	None	1,300/51	TSS, SS, Fe, oil and grease, trace metals

*TSS = Total Suspended Solids; DS = Dissolved Solids; Fe = iron.

Source: United States Steel Corporation; Arthur D. Little, Inc.

Table 4- 314

Surface Runoff From Site During Plant Operations (Quality Subsequent to Treatment, Prior to Discharge)

Expected Receiving Water Body	Operation	Approximate Area Hectares (Acres)	Estimated Runoff Coefficient*	Estimated Average Runoff Flow Rate: 24 hr Storm** (m^3/hr)	Estimated Average Runoff Flow Rate: Annual*** (m^3/hr)	TSS	TDS	pH	O&G	TOC	COD	SO_4	F	Fe	Ni	Zn	Cr	Comments
Conneaut Creek	Raw Materials Storage	25(62)	0.85	560	21 (a)	<30-60	NE	6-9	BP	NE	NE	NE	NE	BP	NE	NE	NE	(b)
	Coal Blending Area																	
	Coal Piles	12(30)	0.90	285	11 (a)	<30-60	<16,000	6-9	NE	NE	NE	<9,000	NE	<20,000	NE	<4	<8	(b)
	Other	19(47)	0.40	200	8	<30-60	NE	6-9	<2.0	<1,000	<10,000	NE	NE	NE	NE	NE	NE	(b)
	General Developed Plant Areas	26(63)	0.30	200	8	<30-60	NE	6-9	<2.0	<35	<130	BP	BP	NE	NE	NE	NE	(b)
	Total	82(202)	-	1,245	48	-	-	-	-	-	-	-	-	-	-	-	-	
Lake Erie	Blast Furnace and Slag Processing	6(15)	0.30	50	2 (a)	<30-60	NE	7-8.5	NE	NE	NE	NE	0.1	<0.01	<0.01	<0.01	BP	Heavy metal concentrations are for dissolved metals only (b)
	Q-BOP Slag Processing	6(15)	0.30	50	2 (a)	<30-60	NE	6-9	NE	NE	NE	NE	NE	BP	BP	BP	BP	(b)
	Diked Oil Storage Area	2(6)	0.90	55	2	<30-60	NE	~7	BP	NE	NE	NE	NE	NE	NE	NE	NE	Concentrations of oil will be variable; may be very high (b)
	General Developed Plant Area (c)	640(1,580)	0.30	5,018	192	<30-60	NE	6-9	<2.0	<35	<130	BP	BP	NE	NE	NE	NE	(b)
	Roofed Areas (e)	53(130)	0.95	1,305	50	-	NE	-	-	-	-	BP	BP	NE	NE	NE	NE	Discharged through main outfall
	Undeveloped Plant Areas	270(662)	0.30	2,165	83	<1,000	NE	4-7	NP	NE	NE	>8.5	NE	NE	NE	NE	NE	Changes in quality from baseline conditions will be due only to rainfall scavenging (b)
	Fine Grained Solid Waste Lined Disposal Areas (d)	66(162)	0.95	1,630	60	<30-60	NE	6-9	NP	NE	NE	NE	NE	NE	NE	NE	NE	(b)
	Total	1,049(2,590)	-	10,270	391	-	-	-	-	-	-	-	-	-	-	-	-	(b)
Lake Erie Tributaries	Bulky Solid Waste On-Land Disposal Area (d)	11(28)	0.85	250	10	<30-60	NE	6-9	NE	NE	NE	BP	BP	BP	BP	BP	BP	(b)
	General Developed Plant Areas (Also includes Penn Central Railroad)	54(133)	0.30	420	16	<30-60	NE	6-9	<2.0	<35	<130	BP	BP	NE	NE	NE	NE	
	Total	65(161)	-	670	26	-	-	-	-	-	-	-	-	-	-	-	-	

The column group TSS through Cr is headed "Estimated Typical Average Quality of Runoff During Storm Events (mg/l)****".

*The runoff coefficient is the non-dimensional ratio of the runoff rate to the rainfall rate.
**The average (over 24 hours) rate of runoff low from the area in question that would be generated by a 2.5 inch rainfall within a 24-hour period. Such a storm has a frequency of occurrence of approximately once every two years.
***Based on an average annual rainfall of 35 inches. Excludes runoff or leachate generated by the spraying of stockpiles to suppress dust; such runoff would likely be recycled.
****Abbreviations as follows: Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Oil and Grease (O&G), Total Organic Carbon (TOC), Chemical Oxygen Demand (COD), Not Estimated (NE), Not Present in Significant Quantities (NP), Believed Present in Possibly Significant Quantities (BP). Total concentrations are given. Units used are mg/liter except for pH, expressed in standard units.

(a) *Includes runoff or leachate generated by the spraying of stockpiles to suppress dust.* Recycled runoff water will be used for spraying to the extent possible. Thus, spraying activities may generate no additional runoff or leachage, and in fact may reduce the quantities of runoff or leachate by improving the efficiency of the evaporation process.
(b) Phenols, cyanides and ammonia are believed to be present in significant quantities.
(c) Includes refractories disposal areas.
(d) Areas calculated assuming 20 years accumulation of waste.
(e) Before the roof runoff enters the final equalization pond, water quality is estimated to be: TSS (120-600 mg/l), pH (4-7), O&G (<2.0 mg/l), TOC (<35 mg/l), and COD (<130 mg/l). Phenols, cyanides and ammonia are believed present in significant quantities. The roof runoff will mix with the process waste water flows in the equalization pond; hence, water quality can be estimated for only the combined outfall flow.

Source: Arthur D. Little, Inc. estimates.

following a heavy rain, combined with a low-flow on the creek, could produce a noticeable impact. A quantitative analysis of the impacts on Conneaut Creek is not possible due to the high fluctuation and variability in both the quantity and quality runoff. Also, while a significant amount of data are available on the water quality of raw runoff, very little are available on treated runoff, i.e., runoff that has been impounded, equalized, neutralized, treated with polymer, or otherwise treated for suspended solids removal, pH adjustment, and general equalization. However, the overall effect on water quality beyond the outfall will be masked by the first flush effect of stormwater effluents from the city of Conneaut.

4.679
Impacts on Turkey Creek water quality during the operational phase result from surface runoff, perturbation of drainage and flow caused by the culvert, the shading effect of the culvert, replacement of natural stream bottom with concrete, and augmentation of flow with Lake Erie water.

4.680
Contaminated runoff from developed plant areas will be diverted to holding basins and treated or recirculated in accordance with regulatory standards and requirements. After treatment, most runoff would be discharged into Lake Erie rather than Turkey Creek or Conneaut Creek. Runoff from undeveloped areas in Turkey Creek drainage would flow undisturbed to the creek. The section of Turkey Creek adjacent to developed areas will flow through a culvert which should prevent the entrance of uncollected contaminated runoff, if any, into the creek. However, the lower 1,500 feet of Turkey Creek will be open, in its natural state, and could be subject to uncollected contaminated runoff unless preventative measures, such as an interceptor ditch, are implemented.

4.681
The culvert installation could effect hydraulic perturbations throughout the watershed (increased drainage rates and flow) leading to accelerated erosion and sedimentation upstream and downstream of the culvert. This would create high level of total solids and adversely affect water quality. Proper design of the culvert and the baffle system would minimize these impacts. The shading effect and the location of the culvert in deep soils will tend to slightly reduce water temperatures in the summer and possibly warm the water during the winter. Temperatures in the culvert section and areas downstream of the culvert should be more constant due to the relatively constant temperature of the surrounding deep soils.

4.682
Dissolved oxygen content in waters below the culvert should be relatively high due to cooler water temperature in the summer and possible aeration effects from the baffle system. The replacement of natural stream bottom with the concrete culvert may decrease the amount of organic material in the water since it will remove 7,500 feet of streambed which originally contributed organic materials to the water column. Additionally, the amount of organic matter which falls into the stream from overhanging vegetation or by runoff will be reduced by the culvert.

4.683
The effect on water quality of introducing Lake Erie water to lower Turkey Creek has not been accurately defined. However, comparisons between Lake Erie water samples (LE9) and those from Turkey Creek (TC1, TC3, and TC4) during June, August, and October indicate that for most parameters changes would be negligible. Only levels of total Fe, phenol, TKN, pH, and dissolved solids exhibited a constant differential between lake and stream waters. For each of these parameters, except pH, values were greater in Turkey Creek.

4.684
Consequently, flow augmentation with Lake Erie water may decrease the concentrations of total iron, phenol, TKN, and dissolved solids in lower Turkey Creek. Further, a slight but measurable increase in downstream pH may result as Lake Erie waters are characteristically more alkaline. Although other variations in water quality parameters were noted, none appeared to exhibit a consistent pattern of higher or lower values. Further, the magnitude of variation was not considered significant. Table 4-315 compares monthly sampling results for six important water quality parameters at Stations TC1, TC3, TC4, and LE9. Significant differences in heavy metals or trace elements were not found, with the exception of iron. During the late summer months and early fall, Lake Erie bottom water temperatures (30-foot contour) were slightly higher than temperatues recorded in Turkey Creek.

Impacts on Surface Runoff

4.685
It is not known at this time whether the average rate of runoff from the project site would increase or decrease as a result of plant operations. The overall change would depend primarily on the difference in permeabilities between the crushed slag surface of the developed plant areas and the original (relatively impermeable) vegetated soil. Characteristics of the plant that would tend to increase total runoff flow include the lack of vegetation and the presence of large paved or built up areas. In some cases, a decrease in total

Table 4-315

Comparison of Water Quality Parameters Relative to Turkey Creek Flow Augmentation

	TC1	TC3	TC4	LE9
<u>April</u>				
Temperature (^{o}C)	15	19.8	22	
DO (ppm)	7.6	7.8	8.5	
Sp. Cond. (μmhos/ cm)	-	540	480	
pH	7.5	7.6	7.7	
Total Hardness (ppm)	144	142	148	
Dissolved Solids(ppm)	260	287	306	
<u>May</u>				
Temperature	ND	ND	ND	9.8
DO	ND	ND	ND	10.3
Sp. Cond.	ND	ND	ND	305
pH	ND	ND	ND	7.95
Total Hardness	ND	ND	ND	144
Dissolved Solids	ND	ND	ND	219
<u>June</u>				
Temperature	20.2	18.5	20.0	19.5
DO	10.7	8.5	10.0	9.4
Sp. Cond.	670	795	850	242
pH	7.9	7.7	8.9	8.3
Total Hardness	194	210	220	127
Dissolved Solids	392	470	544	222
<u>August</u>				
Temperature	21.1	21.3	23.00	23.4
DO	9.0	9.7	8.3	8.5
Sp. Cond.	165	170	240	295
pH	7.5	7.5	7.5	7.75
Total Hardness	134	140	148	149
Dissolved Solids	222	232	235	192
<u>October</u>				
Temperature	13.9	12.1	12.2	14.9
DO	9.4	9.5	9.6	9.35
Sp. Cond.	340	340	380	305
pH	7.4	7.4	7.5	8.05
Total Hardness	110	122	134	142
Dissolved Solids	205	219	206	191

runoff may occur on some parts of the site as a result of grading and leveling. As a result of the presence of the plant, the dynamics of the stormwater runoff may change significantly. Runoff from all developed areas (excluding roofed areas) will be impounded and treated and could be discharged to local water bodies in a relatively constant stream. Additionally, drainage basin boundaries will be changed, although the boundaries of the new drainage basins have not yet been determined, nor have the locations of the treatment ponds or the discharges. Possible average runoff flows from the plant during operations have been summarized in Table 4-314, based on the best estimates of plant drainage at this time.

4.686
Runoff from the proposed Lakefront Plant will be degraded as accumulated pollutants lying on the ground surface or on roofs are removed by the water flow. These pollutants accumulate as a result of the atmospheric fallout of plant emissions (primarily the larger particulates associated with fugitive emissions) and the spillage of materials during materials handling and transfer. Runoff from materials storage piles is contaminated by the pollutants within the materials themselves. Plant runoff will additionally be degraded by any pollutants washed out of the atmosphere by rain. The preliminary results of a study being conducted by The Research Corporation of New England (TRC) for the Industrial Environmental Research Laboratory of the EPA indicate that, in general, those areas of steel plants offering the greatest potential threat to the quality of stormwater runoff include coal storage piles, coke storage piles, slag piles, iron ore storage piles, and coal and coke handling areas. Improperly designed or insufficiently sized sludge disposal sites, tar storage sites, and chemical waste disposal sites were also observed to present special problems at some plants. Their preliminary results also indicated that contaminated stormwater runoff may contain the following pollutants in significant concentrations: total suspended solids, total dissolved solids, phenols, cyanides, ammonia, total iron, dissolved iron, and sulfates. Organics, oil, and grease were not observed to be industry problems. (4-53)

4.687
Given the state of the art, it is impossible to accurately characterize in advance the quality of stormwater runoff from the proposed Lakefront Plant site during normal operations. The available data on the quality of runoff from iron and steel facilities are extremely limited and are rarely consistent either across drainage basins within a specified industrial area or from a particular area of one plant to a similar area of another. Furthermore, the proposed facilities will differ from existing steel facilities in the country and thus, runoff data from other steel facilities may be of limited applicability.

4.688
The applicant's consultant has concluded that the stormwater runoff from the proposed plant during operations could be of higher quality than the runoff from most currently operating iron and steel facilities. This conclusion is based on the fact that fugitive emissions from the proposed plant will be relatively low, thus minimizing the pollution loadings to the ground surface and runoff pollution. Additionally, most runoff from the plant areas will receive at least primary treatment. Operational characteristics relating to the applicant's conclusion are listed below:

- Plant Layout - The proposed plant is designed to reduce materials transfer to a minimum. Since the plant operations most likely to degrade runoff are those that involve materials transfer, the layout would tend to minimize runoff pollution.

- Sophisticated Materials Transfer System - In general, rail or other vehicular transport will not be used to transfer materials from one part of the plant to another. Closed mechanized conveyors will be relied upon, eliminating material spillage and reducing fugitive emissions.

- Advanced Technology in Plant Design - The proposed plant will have large-scale units with minimum surface to volume ratios. The production levels from each unit process will be balanced, eliminating the need for exposed stockpiling of in-process materials. Furthermore, the iron and steel plants will be totally enclosed under one contiguous roof with no external transport of molten metals required. The most advanced practices in raw materials preparation will be used to assure high reliability and continuous operation, minimizing turndown time and startup time. These design features will all serve to reduce fugitive emissions.

- Tighter Control of Fugitive Emissions - Some potential sources of fugitive emissions will be eliminated as a result of the plant layout and design and the materials transfer system. Dust suppression will be applied at those remaining sources of potentially major fugitive emissions.

- Treatment of Runoff - Runoff from the roofed areas and the undeveloped plant areas shown in Figure 4-98 would likely be discharged to Lake Erie without treatment; all other runoff will be treated prior to discharge to meet the proposed new source performance standards (29 March 1976) regarding miscellaneous runoffs from iron and steel facilities as listed in Table 4-316.

Table 4- 316

Proposed EPA New Source Performance Standards for Runoff from Iron and Steel Industry Facilities -- March 29, 1976

		Effluent Limitations
Effluent Characteristic	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed -
TSS	75 mg/1 (1)	25 mg/1 (1)
pH	Within the range 6.0 to 9.0	

(1) This concentration limit applies only when the rainfall rate is 2.5 in. per day or less in any preceding 5-day period.

4.689
Treatment would consist of gravity settling aided, if required, by lime and polymer conditioning. The applicant has predicted that operations of the proposed plant will cause additional surface water loadings of ammonia, COD, solids, zinc, iron, phenols, cyanides, and ammonia are expected to be present in significant quantities in runoff from all developed areas of the plant site.

Specific Sources of Pollution

4.690
For the purposes of this discussion the following areas have been identified as potential sources of polluted runoff: slag processing area; oil storage area; solid waste disposal areas; coal piles and coal blending areas; raw materials storage area; other developed plant areas; roofed areas; undeveloped plant areas; access roads. Summary information on runoff from some of these areas is presented in Table 4-317.

4.691
The quantitative aspects of the discussion have summarized and presented earlier in this section in Table 4-314. These results can be compared with baseline runoff characteristics, (see Table 4-318) as estimated from Turkey Creek water quality data obtained during a storm event. Due to the land use mix in the Turkey Creek Drainage Basin, these data are considered representative of rural runoff in the Regional Study Area. Concerning the impact of plant operations on runoff, the following specific points are noted:

- Although the Lakefront Plant site under baseline conditions is basically a rural area, the baseline pollutant loadings of phosphorous and nitrogen appear relatively low compared to reported values for rural areas throughout the nation. Most likely, this effect is caused by the abundance of woodlands and brushlands in the area rather than fertilized cropland or feedlots. While baseline loadings of nutrients are low, it is necessary to maintain these low levels in the future to insure that nuisance growths of aquatic plants and water quality degradation do not occur. The potential effects of increased nutrient loading are discussed later in this chapter in the section entitled "Impacts of Secondary Growth on the Water Quality of Lake Erie." The observed baseline BOD^5 and fecal coliform loadings are comparable to those reported in runoff from other rural areas throughout the nation.

- Measurable quantities of ammonia, COD, solids, zinc and iron are present in the runoff under baseline conditions, with iron concentrations at significant levels. The operation of the lakefront plant would likely cause additional loadings of these pollutants in the runoff water.

Table 4- 317

Summary Information on Runoff from the Proposed Plant

Runoff From	Treated By	Discharged To	Estimated Flows: 2.5 in. Rain Over 24 Hrs / Annual Average (m^3/hr)	Principal Constituents of Interest(1)
Raw Materials Storage Area	Gravity settling and, if necessary, lime and polymer conditioning	Conneaut Creek	560/22	TSS, DS, Fe, trace metals (acidity, sulfates from coal piles)
Coal Blending Area	Gravity settling and, if necessary, lime and polymer conditioning	Conneaut Creek	535/21	TSS, DS, Fe, trace metals (acidity, sulfates from coal piles)
Developed Plant Areas Excluding Roofed Areas	Gravity settling and, if necessary, lime and polymer addition	Conneaut Creek Lake Erie	8,000/315	TSS, DS, phenols, cyanides, ammonia, iron, sulfates, oil and grease
Roofed Areas	No treatment	Lake Erie via main outfall (offshore)	1,300/52	TSS, DS, phenols, cyanides, ammonia, iron, sulfates, oil and grease
Undeveloped Plant Areas	No treatment	Nearest water body	Unknown	Mostly background constituents
On-Site Solid Waste Disposal Areas	Impoundment and treatment as required. Leachate also treated if required	Lake Erie	110/<5)	TSS, DS, metals, others
Oil Storage Area	Impoundment	Lake Erie	55/2	Oil and grease

(1)TSS = Total Suspended Solids; DS = Dissolved Solids.

Table 4- 318

Concentrations of Contaminants in Baseline Runoff from
Turkey Creek (TC-4) -- 13 September 1977

Parameter (mg/l)	Base Flow	Rainfall	Runoff (Estimated)[(1)]
BOD_5	1.2	1.6-1.8	>7.0
COD	17.0	4.0-4.8	65.0
Fecal Coliform (Colonies/100 ml)	1,400.0	<4.0	>50,000.0
NO_3 - N + NO_2 - N	1.2	0.49-0.51	0.6
NH_3 - N	0.06	<0.02-0.04	0.12
Total Kjeldahl Nitrogen	0.54	0.35-0.38	0.36
Total PO_4 - P	0.04	<0.003	0.4
Soluble Reactive Phosphate	0.010	<0.003	0.04
SO_4	50.0	3.3	35.0
Solids (Total)	570.0	<39.0	750.0
pH	7.8	4.3-4.6	7.1
Phenols	0.009	0.015-0.019	0.008-0.016
Al	-	-	<0.02
Cd	<0.01	<0.01	<0.01
Cr	<0.01	<0.01	<0.01
Cu	<0.01	<0.01	<0.01
Pb	<0.03	<0.03	<0.03
Hg	<0.0005	<0.0005	<0.0005
As	<0.03	<0.03	<0.03
Cyanides	<0.005	<0.005	<0.005
Fe - Total	0.33	<0.01	5-6
Fe - Dissolved	0.13	<0.01	1.0
Zn	0.03	0.01	0.18

(1) Includes contribution of rainfall.

Source: Personal Communication, Mr. Richard E. Mazinski, Penn Environmental Consultants, September 21, 1977.

- Phenols have been washed out of the atmosphere by falling rainwater and are present in the runoff under baseline conditions in potentially significant quantities (0.008-0.016 mg/l). Similarly, the presence of acidity and nitrites in the runoff is primarily due to rainfall scavenging. The operation of the proposed Lakefront plant would likely cause additional loadings of phenols in the runoff waters.

- Under baseline conditions, cadmium, chromium, copper, lead, mercury, and arsenic and cyanides are not present in runoff in significant quantities. It is likely that copper and cyanide will be introduced into the runoff during plant operations. Cadimum, chromium, and lead may also be introduced.

- Sulfates are present in acceptable concentrations under baseline conditions. During plant operations, the concentrations of sulfates and consequently of total dissolved solids, may increase significantly.

4.692
Some of the characteristics of Table 4-314 influences its use and applicability for the assessment of runoff impacts. For example, although this table can be used to perform a first order assessment of the impacts of runoff to local surface water, the locations of the discharges have not been fixed and the expected receiving water bodies indicated in the table are tentative. Furthermore, the quality of runoff generally improves as the distance from the pollutant source increases. Thus plant areas located far from the receiving water body may tend to have a diminished impact. The typical quality of discharge from a design storm is presented in Table 4-314. A storm larger than the design storm (refer to Table 4-316) is expected with an average frequency of once every two years and would result in runoff at higher flows and of a possibly lower quality than is indicated in the table. Overall the value of these data may be questionable since only one storm event was used to establish baseline conditions.

4.693
Slag Processing Area. It is estimated that approximately 30 acres of the project site will be devoted to slag processing and storage, including 12 acres devoted to a storage/working pile of blast furnace slag and 12 acres devoted to a storage/working pile of Q-BOP slag. Runoff from blast furnace slag will likely be basic in chemical character and may contain relatively high sulfur concentrations. The results of a chemical analysis of blast furnace slag leachate are presented in Table 4-319. Runoff can be significantly less concentrated than leachate, by an order or magnitude or more. Based on

Table 4- 319

Analysis of Leachate from Blast Furnace Slag

	Concentration (ppm)
Ag	0.015
Ba	0.20
Cd	0.013
Cr	None Detected
Cu	0.02
Fe	0.02
Mn	None Detected
Ni	0.045
Pb	0.06
Zn	0.025
B	1.5
As	<0.010
Hg (total)	<0.0020
Hg (inorganic)	<0.0020
Se	0.092
CN	--
S	1225.0 (0.49%)
pH (Standard Units)	8.8

Source: United States Steel Corporation.

conversations with the National Slag Association and knowledge of the material, the applicant believes that Q-BOP slag has trace quantities of such heavy metals as lead, zinc, chromium, cadmium, manganese, iron and nickel. These metals would be found in unknown concentrations in the runoff from the Q-BOP slag. Slag storage piles will be watered to suppress dust. Recycled runoff water will be used for spraying to the extent possible. The estimated quantity and quality of runoff from this area are summarized in Table 4-316. Discharge would likely be to Lake Erie. The concentrations of sulfur and heavy metals in the runoff may be high enough to be considered significant.

4.694
Oil Storage Area. Approximately 5.5 acres of the site will be devoted to oil storage. The spill prevention plans are to be developed as a part of the final plant design and will be based on conventional engineering practice for containment, control and treatment as appropriate for more than 100 percent of the tank storage capacities. The storage area will be surrounded by a dike to contain any spilled oil. Stormwater runoff from this area will be removed through drains, impounded and treated with runoff from other plant areas and most likely discharged to Lake Erie. Under normal operating conditions, the oil will be confined to storage tanks. However, oil may leak to the ground as a result of a tank puncture or overflows, which may occur. These spills will be contained and cleaned as they occur to the extent possible. In either case, residual oil would coat portions of the ground surface within the diked area, either all or some portion of it. Some of the oil fractions would be broken down by bacterial action, with amounts and rates of microbial degradation highly spill-specific. Additionally, some of the oil would evaporate while the rest might be absorbed into the soil if (as planned) the diked area is not lined with an impermeable liner. Until the oil were completely removed by one or more of the above processes, some oil would be present in the stormwater runoff from this area, possibly, in high concentrations. The loadings of oil in the runoff could remain substantially unaffected by the proposed runoff treatment process (i.e., temporary impoundment).

4.695
Solid Waste Disposal Areas. The estimated acreage required for solid waste disposal on the site are presented in Table 1-41. The types of solid wastes and their chemical constituents are shown on Tables 1-37 through 1-39 and 1-40. Runoff (overflow) from the diked areas containing the fine grained solid waste is expected to be alkaline and high in total dissolved solids (e.g., calcium and sulfate). The wastewater would be treated to conform with the proposed New Source standards and other applicable regulatory standards. The treated wastewater would probably be gravity-drained to Lake Erie (via a

storm sewer). Runoff from as yet undeveloped areas adjacent to the diked disposal areas will be diverted and drained to Lake Erie. Estimates of the quantity and quality of the flow are summarized in Table 4-314. As at most steel manufacturing facilities, the developed portions of the site adjacent to individual process units would contain significant amounts of phenol cyanide and ammonia. Estimates on the quantity and quality of runoff from this area cannot be made due to lack of specific design information on collection and treatment systems. However the runoff, even when treated, will probably contain relatively significant concentrations of heavy metals and trace elements. On the other hand, the runoff from the undeveloped portions of the plant site is expected to be of relatively good quality. Originally, the applicant had planned to deposit refractories in those portions of Turkey Creek dewatered as a result of the diversion of the upper watershed. Since this plan is no longer viable, the applicant has advised that the required disposal facilties would be relocated to suitable areas within the developed portion of the Lakefront site. Refractories are chemically stable by nature and runoff from refractory disposal areas is expected to contain only those pollutants in the rainwater plus possible additional suspended solids of undertermined quantity. Drainage would likely be to Lake Erie.

4.696
The bulky solid wastes, which include hot metal desulfurization slag and general plant refuse, would be stored in piles on unexcavated land. This would be accomplished by depositing the waste material in layers covering it on a daily basis with soil and compacting. Use of the soil cover may not be required by the Pennsylvania Department of Environmental Resources if garbage and readily biodegradable materials are omitted. The slag will be alkaline in nature and may contain Al_2O_3, S_iO_2, FeO, MnO, MgO, calcium compounded with sulfur, iron compounded with sulfur, and alkalies. The slag may also contain the heavy metals chromium, copper, manganese, nickel, lead, and zinc. Runoff from desulfurization slag would likely be alkaline and high in suspended solids. The concentrations of dissolved heavy metals in the runoff would depend on the physical characteristics of the refuse pile and solubilities of the chemical compounds in which the heavy metals are bound. The influence of the general plant refuse on the quality of runoff and leachate from this area is not known. Data obtained at the Lakeview Landfill in Summit Township (the only operating Erie County landfill) indicates that the runoff from this general refuse landfill contains high levels of suspended solids. Total iron and BOD in an adjacent stream were observed to be as high as 45,000 mg/l, 24,500 mg/l and 600 mg/l, respectively. (4-62) Data compiled by the USEPA (refer to letter of comment dated 7 September 1978) on a number of disposal areas similar to the type proposed by the applicant

indicate that contaminants in the runoff and leachate may be present at the following ranges:

Parameter	Range of Values (mg/)
COD	81-33,360
BOD	256-28,000
TSS	10-7,000
NH_3-N	0-1,106
Fe	0-2,820
Pd	.10-2.0
pH	3.7-8.7

4.697
The proposed treatment of runoff and leachate from the bulky solid waste disposal area (refer to Table 4-291) is expected to bring the suspended solids concentrations and the pH to the required levels of the proposed New Source standards. Additional treatment of runoff and leachate may be needed to achieve compliance with other applicable standards. The estimated quantity and quality of the runoff are summarized in Table 4-314. Based on comments received during the review period for the Draft EIS, the applicant no longer intends to discharge treated effluents from the landfill site into Lake Erie. Instead, the applicant has agreed to recirculate the runoff and leachate back to the disposal area effectively eliminating the discharge. This system would be designed in accordance with applicable regulating guidelines.

4.698
Wastes from the hot strip mill, plate mill, and waste treatment plant would contain oil and grease of appreciable concentrations, ranging from 30,000 to 220,000 ppm. The grease component is expected to be composed of silicon compounds which have little or no water solubility. The oil component is subject to evaporation of its more volatile hydrocarbons (those having boiling points less than 370°C). Solubility in water of the remaining hydrocarbons would be very low; however, microbial degradation to more soluble species is possible. Although aerobic microorganisms are most efficient in bio-oxidation of oil, the disposal of these wastes is unlikely to provide an aerobic environment. Facultative anaerobes present in an anoxic environment can utilize compounds such as manganese oxide, ferrous

hydroxide, sulfate, and sulfite as an oxygen and sulfite would probably be the major oxygen sources. Both sulfur dioxide and hydrogen sulfide are byproducts of the reduction reactions. Since essentially all of the oily wastes are expected to be disposed within a lined impoundment, septic odors may be present. If there are substantial amounts of sulfite present in the wastes, or if significant portions of sulfate are converted to sulfite under reducing conditions, discharge of waters flowing through the wastes would cause an oxygen demand on the receiving ground or surface waters. Since the dissolved oxygen level within groundwater is limited and sulfite is not readily attenuated within the groundwater regime, an oxygen demand would largely occur in the event leaching occurred. In the absence of sulfite, the only other oxygen demand that may be attributable to the wastes under consideration would be those due to trace metals in low oxidative states. However, since the dissolved trace element concentrations are expected to be low, there would be little potential for oxygen demand.

4.699
The applicant originally planned to deposit coke plant and sanitary waste sludge on the coal piles. However, this proposal could interfere with the coking properties of the metallurgical coal creating some uncertainty from a process control standpoint. Consequently, the applicant proposes to set aside a separate lined impoundment for these wastes which would be designed in accordance with appropriate regulatory requirements. Containments of the wastes as proposed, would eliminate the potential for interference with the control technology used to treat runoff from the coal piles.

4.700
The applicant estimates that the concentration of trace elements in wastes would be directly proportional to the weight of raw material loss during processing of the iron and steel. Each year the plant would process about 7.8 million tons of pellets, 2.9 million tons of iron ore, 1.4 million tons of limestone/dolomite, and 6.1 million tons of coal in the production of 7.5 million tons of steel of this total 6.4 million tons are shipped, 1.1 million tons are recycled. In addition, approximately 2.6 million tons of residuals would be recycled within the plant. About three million tons of residuals would be recovered and sold; and about 0.22 million tons of the residuals would require disposal. In general, trace element levels in the steel and residuals could increase by a factor of as much as two over those found in raw materials. The resultant solid waste residuals often have undergone a change in the form and availability of the chemical constituents. For example, their initial presence in raw materials may have been as a bulky, highly insoluble mineral matrix, but after going through the iron or steelmaking process may be converted to a fine-grained, moderately soluble matrix.

4.701
The blast furnace desulfurization slag is expected to consist mostly of $CaSO_4$) and an iron calcium sulfate compound. The flue gas desulfurization (FGD) sludge would contain a solid matrix consisting largely of elements where the matrix is mostly $CaSO_4$, and little potential for dissolution of trace elements from a $CaSO_3$ matrix. Leachate date representative of these expected wastes is not available. After an initial first flush of process liquors, the concentrations in any drainage, leachate or decant coming from the waste would approximate equilibrium concentrations. Equilibrium would depend largely on the hardness, ionic strength, pH and oxygen content of the solvent. The concentration of trace elements contained in FGD scrubber liquor is presented in Table 4-320.

4.702
The trace elements in ash are generally present in much higher concentrations than FGD sludge. However, the exposure and production of these materials at high temperatures could lead to formation of stable compounds between some trace elements and the matrix. Thus, the elements themselves may not be as easily leached although the compounds of the elements could be highly leachable. The applicant performed tests by slurrying boiler house flyash with 500 milliliters of water (distilled), stirring for two days and analyzing for the elements. A comparison of the amount of metals leached to the amount originally present (refer to Table 4-321) indicates that a very small amount is leached. Trace elements in the sinter plant debris, metal mixer dusts, and metal fines are not readily dissolved because of the steel matrix in which they exist. Dissolution would be unlikely unless the solvent were acidic. In the absence of strongly acidic materials in the wastes and with the presence of lime in a large portion of the wastes, water coming in contact with the wastes is likely to become alkaline due to the formation of calcium hydrozide. In addition, as these wastes are disposed with those mentioned above, the formation of less soluble calcium salts such as $CaSO_3$ (from $CaSO_4$) may tend to decrease the effective concentration of Ca^{++} in solution and thus drive more hydrated lime to dissolve, further increasing alkalinity.

4.703
Overall, the major dissolved species may be calcium and sulfate/sulfite which are not attenuated or precipitated by soils to any measureable degree. If present, sulfite could be a concern as it causes an oxygen demand of the receiving water when oxidizing to sulfate. Of the trace elements expected to be present, iron, copper, manganese, lead, nickel and zinc would be partially precipitated under neutral to alkaline pH conditions. Lead and copper would absorb onto clay minerals at neutral to alkaline pH. Carbonate salts

Table 4-320

Concentrations of Trace Elements in Typical FGD Scrubber Liquor

Element	Concentration (mg/l)
Sb	0.02-0.009
As	0.0008-0.011
Ba	<0.3
Be	0.002-0.008
B	2.1-11.7
Cd	0.002-0.009
Cr	0.002-0.01
F	3.8-52.7
Ge	0.015-0.39
Hg	0.001
Pb	0.009-0.015
Mn	0.2-2.0
Mo	0.01-0.56
Ni	0.07-0.33
Se	0.04-0.4
V	<0.2
Zn	0.02-0.9
Cu	0.01-0.5

Source: EPRI 202-Environmental Effects of Trace Elements from Ponded Ash and Scrubber Sludge, Radian, 1975.

Table 4- 321

Leaching of Some Trace Metals from Boiler House Flyash

Metal	Amount Present (g)(1)	Amount Leached (g)(2)	% Leached	Concentration in Effluent
Cu	0.056	1×10^{-5}	0.02	0.02
Fe	11.0	1.5×10^{-3}	0.014	3.0
Cr	<0.069	1.25×10^{-5}	0.018	0.025
Mn	0.542	3.75×10^{-4}	0.069	0.75
Pb	0.15	9.0×10^{-5}	0.06	0.18

(1) In 100 grams of Ash

(2) Using 500 milliliters of distilled water, pH of leachate 8.4

Source: United States Steel Corporation.

may form with copper, iron, lead and zinc. Although chromium would be troublesome if it appeared in leachate in the difficult-to-attenuate chromate state, chromic hydroxide generally forms at neutral to alkaline pH under anaerobic conditions and is very insoluble. The surficial geology of the site indicates that beach-deposit or other permeable sediments may be present. These sediments, if underlying waste disposal areas, could act as direct conduits that could flush leachate to the lake. Borings will be made in any waste disposal area to determine the presence of such deposits, so that specific amelorative measures can be formulated to insure protection of water quality.

4.704
Although the proposed solid waste disposal areas are conceptually designed to utilize either in-situ impermeable glacial till or constructed impermable liners to protect the groundwater regime, there is some possibility of leakage if the till is fractured or the liner is punctured, or if there is overflow in the event of severe storms. The extent of impact to groundwater quality would then depend on the attenuative capability of the receiving soils. Table 4.322 provides soil chemistry data from the onsite test pit sampling stations shown on Figure 4.102. Generally, the cation exchange capacity and adsorptive capacity of these soils is mammal due to the relatively low clay and organic contents. The principal attenuative mechanism in precipitation. Since the groundwater flow rate is very low and background groundwater quality has a neutral pH and any leachate derived from the wastes would probably be alkaline, precipitation of most species would probably occur shortly downgradient of the disposal area.

4.705
Coal Storage Area. Wastewater from the exposed coal piles will consist of leachate, produced as water percolates through the storage pile, and runoff from the surface of the pile. The quality of the wastewater will depend on the actual composition of the stored coal, the topography and drainage of the site, the configuration of the stockpile, and the volume, type and intensity of recent precipitation. Runoff and leachate will be produced as a result of natural precipitation (approximately 35 inches per year) and possibly as a result of the planned watering of the piles to surpress dusts. Generally speaking, the leachate is much more degraded than the runoff. Often, the total discharge is most degraded at the beginning of storm events as standing moisture is flushed from the piles.

4.706
Leachate and runoff from eastern coal piles is generally acidic and many contain relatively high concentrations of sulfates and heavy

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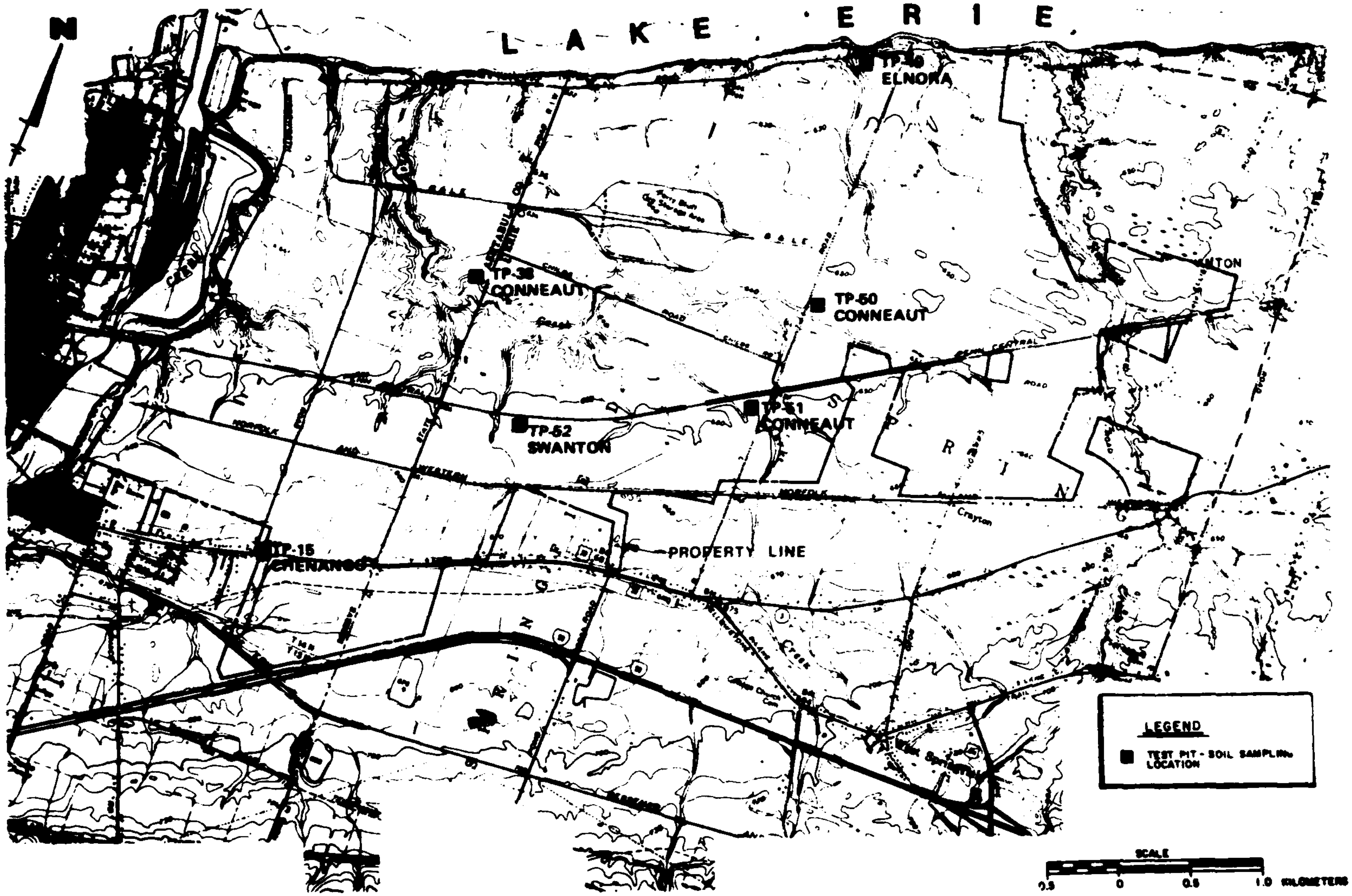
Table 4- 322

Soil Chemistry Data from On-Site Pit Stations

Test Pit Number	Soil Series	Horizon	Sample Depth (cm)	USDA Texture	Course Fragments (>2mm)	pH(1)	Electrical Conductivity(1) (mmhos/cm at 25°C)	Extractable Cations(2) (meq/100g) Ca	Mg	Na	K	Exchangeable Acidity(3) (meq/100g)	Cation Exchange Capacity(4) (meq/100g)
		A1	0-28	Gravelly Sandy Loam	45.4	5.95	0.09	5.26	1.08	0.05	0.18	0.72	7.23
		B2	28-58	Gravelly Loamy Sand	18.3	6.00	0.05	NA	NA	NA	NA	0.36	NA
TP-15	Chenango	C1	58-132	Gravelly Loamy Sand	20.5	5.00	0.04	0.54	0.30	0.01	0.04	0.36	1.25
		C2	132-203	Loamy Fine Sand	0.0	5.20	0.03	NA	NA	NA	NA	0.24	NA
		C3	203-279	Loamy Sand	0.0	5.80	0.06	1.10	0.21	0.01	0.05	0.12	1.49
		A1	0-10	Silt Loam	19.7	4.55	0.16	NA	NA	NA	NA	1.50	NA
		B2	10-91	Silty Clay Loam	0.0	6.00	0.12	NA	NA	NA	NA	0.36	NA
TP-38	Conneaut	C1	91-137	Silty Clay Loam	0.0	6.20	0.19	NA	NA	NA	NA	0.30	NA
		C2	137-203	Silty Clay Loam	0.0	6.90	0.14	NA	NA	NA	NA	0.06	NA
		C3	203-254	Silt Loam	0.0	7.50	0.62	NA	NA	NA	NA	0(5)	NA
		A1	0-23	Loam	0.0	4.65	0.16	2.72	0.47	0.04	0.60	2.16	5.99
		B2	23-102	Fine Sandy Loam	19.7	4.95	0.12	NA	NA	NA	NA	0.72	NA
TP-49	Elnora	C1	102-178	Loamy Fine Sand	0.0	4.70	0.14	0.90	0.31	0.01	0.26	0.84	2.32
		C2	178-254	Loamy Fine Sand	0.0	4.65	0.23	NA	NA	NA	NA	0.96	NA
		C3	254-381	Loamy Fine Sand	0.0	5.75	0.26	1.26	0.70	0.01	0.81	0.60	3.38
		A1	0-20	Silt Loam	0.0	4.50	0.10	2.94	0.69	0.06	0.17	2.28	6.14
		B2	20-76	Silty Clay Loam	0.0	6.10	0.12	NA	NA	NA	NA	0.48	NA
TP-50	Conneaut	C1	76-127	Silty Clay Loam	0.0	6.50	0.15	6.70	2.63	0.09	0.06	0.42	9.90
		IIC2	127-203	Silt Loam	0.0	7.05	0.18	NA	NA	NA	NA	0	NA
		IIC3	203-305	Silt Loam	10.0	7.35	0.73	18.6	1.03	0.04	0.16	0	19.8
		A1	0-15	Sandy Loam	16.0	4.25	0.31	NA	NA	NA	NA	2.70	NA
		B2g	15-122	Silty Clay Loam	0.0	6.20	0.15	NA	NA	NA	NA	0.54	NA
TP-51	Conneaut	C1	122-137	Silty Clay	0.0	7.55	0.21	NA	NA	NA	NA	0	NA
		IIC2	137-203	Silt Loam	0.0	7.70	0.21	NA	NA	NA	NA	0	NA
		IIC3	203-305	Silt Loam	17.6	7.50	0.68	NA	NA	NA	NA	0	NA
		A1	0-15	Coarse Sandy Loam	0.0	4.25	0.29	0.80	0.19	0.10	0.19	2.64	3.92
		B2	15-76	Loamy Fine Sand	0.0	5.45	0.10	2.27	0.65	0.02	0.05	0.54	3.53
TP-52	Swanton	C1	76-178	Loamy Fine Sand	0.0	6.40	0.16	NA	NA	NA	NA	0.36	NA
		IIC2	178-254	Silt Loam	0.0	7.50	0.62	19.0	0.77	0.03	0.14	0	19.9

Notes: (1) 1:1 soil:water paste.
(2) NH_4OAc extractable.
(3) SMP Buffer.
(4) Calculated by summing extractable cation and exchangeable acidity values.
(5) By definition (pH 7.00).
NA = Not Analyzed.
For test pit locations, see Figure 4-117.

Source: D'Appolonia/Haley & Aldrich Joint Effort, report of July 1977.



Source: D'Appolonia/Haley & Aldrich.

FIGURE 4–102 SOIL EVALUATION LOCATIONS

metals. The constituent in coal that exerts the greatest effect on the quality of coal piles leachate or runoff is the sulfur content, or, more accurately, the framboidal pyritic sulfur content. The total sulfur content in eastern coals varies from 0.5 percent to 1.5 percent. The organic sulfur content in these coals is generally between 0.35 percent and 0.5 percent and the remaining sulfur is primarily pyritic. Anywhere between 0 percent and 100 percent of the pyrite may be framboidal pyrite, a fine-grained form that is much more reactive and less stable than the massive secondary pyrite. Iron disulfides existing as framboidal pyrite are available to undergo reactions in an oxidizing environment to produce acidic and leachate.

4.707
The available data on the quality of runoff and leachate from eastern coal piles are summarized in Table 4-323. These data were obtained primarily from coal piles containing relatively high-sulfur coals and thus are of limited applicability in assessing the impact of the low sulfur coal which the applicant proposes to use. Although runoff and leachate from low sulfur coal piles may not be as degraded as runoff and leachate from the higher sulfur content coals, the reaction chemistry is so complex and the influence of the other factors (pile configuration, etc.) so great that no definitive conclusions can be drawn.

4.708
Runoff from this area will be collected and treated by the applicant in one of two ways. Treatment of runoff will be accomplished in the plant process wastewater treatment system. However, the possibility also exists for directing the flow into the treatment system for the raw materials storage area operated by the Pittsburgh & Conneaut Dock Company. The proposed treatment will bring the pH and the suspended solid concentration to acceptable levels. If required by regulatory agencies, the runoff and leachate will be additionally treated.

4.709
Coal blending area runoff or leachate may be recycled and used to spray the pile during dry periods to surpress dust. If untreated runoff or leachate were used, the pH of the spray might fall within the range of 2.8 to 3.2. Several iron bacteria that catalyze the oxidation reactions in the formation of the acid-sulfate drainage are common to just such an acidic aqueous environment. Thus, the runoff and leachate eventually produced by an acidic spray could be severely degraded, require additional treatment, and result in the accelerated production of sludge in the bottom of the holding pond where the treatment of the runoff takes place. The estimated quantity and quality of runoff from the coal blending area are summarized in Table 4-318. Heavy metals, especially iron, could have significant effects on runoff water quality.

Table 4- 323

Quality of Runoff and Leachate from Coal Piles

Source	Total Sulfur Content of Coal (%)	Typical Pollutant Concentrations (mg/l) TSS	TDS	Acidity*	pH	Fe	Al	Mn	SO_4	Zn	Ferrous Iron	Cr	Cu
Warren, PA Penn Electric Co.(1)													
Wet (runoff and leachate)	1.84	1,700-13,000	2,300-115,000	1,900-2,900	2.35-3.36	700-1,400	70-100	9-15	1,600-2,700	-	-	-	-
Dry (leachate)	1.84	12-19,000	2,300-21,700	200-38,000	1.43-3.37	160-23,500	20-1,800	2-100	90-57,000	-	-	-	-
Portland, PA Metropol. Edison Co.(1)													
Wet (runoff and leachate)	1.47	220-3,800	600-7,500	300-4,600	2.35-3.10	18-400	2.75-88	3.75	380-6,000	-	-	-	-
Ithaca, NY Cornell University(2)													
Range	-	-	9,332-14,948	375-8,250	2.2-5.8	10-5,250	-	4.5-72.0	-	2.4-26.0	139-850	0.1-7.5	0.1-6.1
Mean	-	-	11,745	2,562	-	1,144	-	17.1	-	5.9	490	2.6	1.69
USEPA Survey Results(3)													
Range	-	-	720-44,050	-	2.1-3.9	0.17-93,000	-	-	525-21,920	1.6-23	-	0-15.7	16.-3.4
Mean	-	-	16,440	-	2.7	19,540	-	-	9,006	3.64	-	3.27	2.10

*as $CaCO_3$

(1) Brookman, G.T. and W.A. Wade III, Measurement of Non-Point Sources from a Coal-Fired Utility and the Impact on Receiving Waters, TRC, The Research Corporation of New England, Wethersfield CN, 1977.

(2) Anderson, W.C. and M.P. Youngstrom, Coal Pile Leachate - Quantity and Quality Characteristics, in the Journal of the Environmental Engineering Division, Proceedings of the ASCE, December, 1976, pp 1239-1253.

4.710
Raw Materials Storage Area. A variety of raw materials will be stored in piles on an estimate 25 hectare (62 acres) tract of land adjacent to the current Pittsburgh & Conneaut Dock Company operations, including gravel-sized iron oxide pellets, sand-sized iron ore, and gravel-sized limestone. The wastewater is expected to be mildly basic (pH between seven and eight possibly high in suspended solids, and contain on the order of 0.4 mg/l dissolved iron, oil and grease may also be present in significant quantities The proposed treatment (gravity settling supplemented if necessary by lime and polymer conditioning) would result in a discharge that would meet the proposed standards. The receiving water course for these treated effluents is Conneaut Creek. Storage piles will be watered to suppress dust. Recycled runoff water will be used for spraying to the extent possible. The estimated quality of runoff from this area is summarized in Table 4-314.

4.711
Other Developed Plant Areas. Data on stormwater runoff from general plant areas is extremely limited, although studies are ongoing. There are no published data available. However, the quality of runoff (prior to treatment) from general plant areas of the proposed Lakefront Plant has been estimated and presented in Table 4-324. No estimates have been made of the concentrations of total dissolved solids, phenols, cyanides, iron or sulfates in runoff from iron and steel plants although these pollutants have been identified as being possible significant contaminants in the runoff waters. (4-53) The estimated quantity and quality of runoff flows from general developed plant areas is summarized in Table 4-314.

4.712
Roofed Areas. Since a primary source of pollutant loadings to the grounds surface is atmospheric fallout and rainfall scavenging, the quality of runoff from roofed areas is expected to be similar to the quality of runoff from general developed plant areas. Roof runoff will be discharged untreated through the main outfall to Lake Erie. The estimated quantity and quality of the runoff flow is presented in Table 4-314. Roof runoff may have significant impacts on surface water quality as shown in Table 4-314. Total suspended solids may be as high as 600 mg/l and pH as low as four. Sulfur, sulfates, phenols, cyanide, and ammonia may be present in significant amounts.

4.713
Undeveloped Plant Areas. Those areas of the project site that will retain the original vegetation (or be revegetated after construction activities with similar vegetation) are considered undeveloped plant areas. Runoff from undeveloped plant areas is expected to be of

Table 4- 324

Estimated Concentrations of Pollutants in Runoff from General Plant Areas in Iron and Steel Facilities (mg/l)

Pollutants	Range of Typical Values
Total Suspended Solids	120 - 600
Oil and Grease	<0.5 - 2.0
Total Organic Carbon	15 - 35
COD	30 - 130

higher quality than runoff from other plant areas. However, runoff may be degraded compared to baseline conditions due to atmospheric fallout and rainfall scavenging of pollutants emitted by the facility.

4.714
Access Roads. Approximately 20 lane-miles of access roads would be constructed to serve the proposed plant. During the winter season, runoff from the new access roads containing high concentrations of deicing compounds, such as salt, may impact Conneaut Creek, the tributary to Conneaut Creek that parallels the Bessemer and Lake Erie Railroad Line, and the headwaters of an unnamed tributary of Turkey Creek. Chloride concentrations in runoff from treated roadways may be as high as 15,000-25,000 ppm. If a typical salt application is followed by a heavy rainfall, then the additional salt loadings to Conneaut Creek or the Turkey Creek tributary during the storm might be on the order of 600 pounds.*

Discharge Locations for Plant Runoff

4.715
Except for roof runoff (which would be discharged through the main discharge pipe into Lake Erie), the location of discharge points for runoff have not been precisely designated by the applicant. Most of the treated plant runoff would be discharged to Lake Erie. Table 4-317 summarizes some basic information on the projected runoff streams and identifies the like receiving waterbodies.

4.716
Rainfall Scavening of Atmospheric Pollutants. Precipitation is often very efficient in removing trace substances from the atmosphere. These removed pollutants are concentrated within the rain (or snow) and subsequently affect the quality of runoff.

4.717
Other impacts on surface waters include spills of fuel and chemicals while in transport, leaching or spillage of road surface materials during construction and atmospheric fallout or rainfall scavenging of pollutants from road traffic.

4.718
Generally speaking, rainwater receives its constituents either by processes within the clouds, a phenomenon known as rainout, or by

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* (Assuming one-half of a four-lane roadway treated with 300 pounds of salt per lane-mile drains directly into the water body.)

processes below the clouds, a phenomenon known as washout. The total removal process is generally referred to as rainfall scavenging. Observations indicate that the substances removed from the atmosphere in this way are not limited to particulates but may include other aerosols or gases.

4.719
During operations, the plant will emit particulates, hydrocarbons (including phenols), CO, SO_2, NO_x, ammonia and cyanides into the atmosphere. Rainfall scavening (in conjunction with dry weather deposition) is expected to be the major contributor of phenols, cyanides and ammonia to plant runnoff. Phenols and ammonia are already present in rainfall at the project site, although cyanide is not (refer to Table 4-325). Rainfall passing through the plume generated by the plant would experience an increase in sulfate concentration of less than 0.3 mg/l and a decrease in pH no more than 0.2 units. However, these estimates are valid only downwind of the plant where the plume is well mixed. Due to the complexity of this phenomena, the applicant has not attempted to quantify the impact plant emissions will have on the chemical quality of rainfall in the vicinity of the proposed Lakefront site.

4.720
Offsite Impacts -- Quality. The dry weather deposition and rainfall scavenging of atmospheric pollutants emitted by the plant, is expected to affect the quality of rainfall and runoff outside the Lakefront Plant site. Pollutants of concern may be cyanide, ammonia, sulfates, phenols, and acid rainfall.

4.721
The greatest impacts will not necessarily be observed in the vicinity of the plant. For example, impacts on rainfall quality are expected to peak approximately 20 kilometers downwind of the plant, where the sulfate levels in rainfall might be increased by as much as 0.3 mg/l and the pH might be depressed as much as 0.2 units. As indicated earlier however, most of the atmospheric pollutants emitted by the plant will be carried out over Lake Erie and would therefore not impact runoff quality.

Impacts of Abnormal Events

4.722
There is some potential for material spills to occur around the storage facilities, such as the oil tanks in the oil storage areas. Similarly, there is potential for spills around the coal-chemical plant tank farm where crude light oil, liquid anhydrous ammonia, sulfuric acid (or molten sulfur), and excess ammonia water will be

Table 4- 325

Chemical Composition of Precipitation

Parameter (mg/1)	Lake Ontario Basin[1] 1970-1971 Range	Volume Weighted Mean	Project Site[2] 1977	Other Data[3]	St. Louis Missouri[4] (Typical Values)	Comments
Total Phosphorus as P	0.002- 0.548	0.060	--	0.003 - 0.087	--	
Reactive Orthophosphate as P	0.000- 0.322	0.029	--	--	--	
Soluble Reactive Phosphorous as P	--	--	0.003	--	--	
Total Kjeldahl Nitrogen as N	--	--	0.35 -0.38	--	--	
Nitrate + Nitrite as N	0.43 - 4.30	1.11	0.49 -0.51	--	0.47 - 2.37	High Inorganic Nitrogen is associated with urban areas
Ammonia as N	0.02 - 2.70	0.594	0.02 -0.04	0.340 - 0.548	0.095- 0.78	
Phenols	--	--	0.015 -0.019	--	--	
Cyanides	--	--	0.005	--	--	
Sodium	0.40 - 10.77	2.01	--	0.16 - 4.50	--	Affected by Winter road salting
Potassium	0.14 - 5.75	0.50	--	0.08 - 1.10	--	Affected by Winter road salting
Calcium	1.00 - 18.00	4.10	--	0.43 - 6.18	--	Affected by Winter road salting
Magnesium	0.0 - 2.50	0.65	--	0.11 - 1.55	--	Affected by Winter road salting
Cloride	0.20 - 7.70	1.18	--	0.45 - 4.80	--	
Sulphate	0.50 - 28.50	8.24	3.3	4.3 -70.	2.53 -24.7	Associated with urban areas
Lead	0.0 - 0.360	0.020	<0.03	0.0048- 0.034	--	Associated with urban areas
Iron	0.001- 0.220	0.031	0.01	0.107	--	Associated with urban areas

Table 4-325 (Continued)

Parameter (mg/l)	Lake Ontario Basin[1] 1970-1971 Range	Lake Ontario Basin[1] 1970-1971 Volume Weighted Mean	Project Site[2] 1977	Other Data[3]	St. Louis Missouri[4] (Typical Values)	Comments
Zinc	0.012- 0.300	0.077	0.01	0.01 - 0.890	--	
Copper	0.001-048	0.006	<0.01	0.0044- 0.021	--	
Cadmium	0.0 - 0.012	0.001	<0.01	0.0031	--	
Nickel	0.0 - 0.022	0.004	--	--	--	
Arsenic	--	--	0.03	--	--	
Mercury	--	--	<0.0005	--	--	
Chromium	--	--	<0.01	--	--	
pH	--	--	4.3 -4.6	--	3.65 - 5.42	
BOD_5	--	--	1.6 -1.8	--	--	
COD	--	--	4.0 -4.8			

(1) Shiomi, M.T. and K.W. Kuntz, Great Lakes Precipitation Chemistry: Part 1, Lake Ontario Basin, Great Lakes Research, 1973, in Proc. 16th Conf. Data is for bulk precipitation and thus includes dry fallout.

(2) Personal Communication (Richard E. Mazinski, Penn Environmental Consultants, Inc., September 21, 1977.) Data is for rainfall only and does not include dry fallout.

(3) Shiomi and Kuntz, op. cit.; Streumpler, A.W., Trace Metals in Rain and Snow During 1973 at Chadron, Nebraska. Atmospheric Environment, 10 (1): 33-37, 1976; Air Chemistry and Radioactivity, C.E. Junge; Academic Press, N. Y. and London, 1963.

(4) Dana, M.T. et al. Precipitation Scavenging of Inorganic Pollutants from Metropolitan Sources, prepared by Battelle Pacific Northwest Laboratories, for the National Environmental Research Center, June 1974.

stored. Precautionary measures will be implemented as part of the plant design for standby emergency use. If a spill were to occur during a rainstorm, the spilled material would immediately contaminate the runoff. However, if a spill were to occur during dry weather, its impact on runoff would depend on the effectiveness of the emergency cleanup actions. In either case, temporary impoundment of the polluted runoff or other such emergency measures would likely be feasible, since all stormwater runoff from developed plant areas is planned to be channeled and passed through some type of treatment facility (e.g., settling basin) under normal operation conditions. Spills may also occur from punctured tank trucks or railroad tank cars carrying by-products from the plant. The impacts of such spills on runoff would depend on the nature, extent and location of the spill and the promptness and effectiveness of cleanup actions.

Secondary Impacts

(1) Impacts of Secondary Growth on the Water Quality of Lake Erie

4.723
The most significant impact of secondary development on the water quality of Lake Erie would result from increased volumes of sewage effluent generated in the watershed. Table 4-326 presents projected increases of the average sewage flow rates, BOD_5 and phosphorus discharge rates. It is projected that sewage flow rate for the area would increase substantially by 1990 without the proposed plant, and that the impact of the plant would result in a noticeable additional sewage burden over the baseline 1990 conditions, especially in Conneaut City and Northwest Erie, where the proposed plant impact will increase the 1990 baseline by more than 33 percent. Findings of Dalton, Dalton, Little & Newport (4-54) for other urban areas in the Lake Erie basin indicate that the increased pollution control measures may not be able to offset the increasing wastes of a growing population. The impact of secondary growth accompanying the proposed plant over the projected 1990 conditions has been investigated for BOD_5 and phosphorus.

4.724
These two parameters are espcially important because of their effects on DO in the lake. High BOD_5 loading will lead to reduced oxygen concentrations at river mouths, harbors, bays, and contiguous nearshore areas. The effects of increased phosphorus loading however, are more widespread in that phosphorus loadings have been reported to be the prime cause of the man-induced eutrophication of Lake Erie. (4-55) Phosphorus can stimulate algal production, which overload the

Table 4- 326

Expected Changes in Sewage Effluent

	Sewage Flow Rate (MGD)			BOD (lbs/day)			Phosphorus (lbs/day)		
	1975	Baseline 1990	Impact 1990	1975	Baseline 1990	Impact 1990	1975	Baseline 1990	Impact 1990
Conneaut City	2.0	2.7	3.6	117	157	210	27	36	48
Northwest Erie	0.8	2.1	2.8	239(1)	525	700	31*	17	23
Ashtabula City	4.0	7.6	8.3	666	1277	1383	33	63	69
Erie City	55.0	80.7	81.0	13744	20115	20242	458	672	675
Totals	61.8	93.1	95.7	14766	22115	22535	549	788	815

(1) The 1975 Northwest Erie figures represent the Lake City plant and the Girard Plant in 1973, the effluent characteristics for these plants were as follows:

	MGD	BOD	Phos
Girard	0.34	25 mg/1*	8.56 mg/1
Lake City	0.42	48	2.12 mg/1

*1 mg/1 = 8.33 lbs per million gallons.

Source: Arthur D. Little, Inc. estimates.

lake with organic matter. As this material falls to the lake bottom, it consumes dissolved oxygen, leading to anoxia in the deeper portions of the central basin. In other words, phosphorus loading leads to increased BOD in the lake, perhaps far from the phosphorus source. Based on present data, it is not known whether or not phosphorus is the limiting factor controlling the growth of algae and phytoplankton in the central basin of Lake Erie. Nitrogen, light, and available substrate may be limiting for certain species or situations. However, total municipal inputs of phosphorus to Lake Erie show a marked correlation with the Central Basin oxygen depletion rate from 1931 to 1966 (4-55), apparently as a result of the stimulation of algal growth by phosphate. Dalton, Dalton, Little & Newport express the opinion that turbidity and lack of available substrate limit Cladophora blooms on the south shore of the Central Basin.

4.725
Phosphorus contamination of Lake affects the entire lake directly or indirectly. Although the greatest inputs of phosphorus are in the tributaries of the Western Basin, the severe dissolved oxygen depletion of the Central Basin attests to the lakewide impact of phosphorus inputs. The projected impact of secondary growth is an increase in phosphorus loading of 27 pounds per day or five tons per year. While this amount is small compared to baseline loading of the entire lake, localized effects in the proximity of the discharges could be much more significant. Increased BOD_5 loading has more localized water quality implications, particularly in the areas of river mouths, harbors, and bays. Elevated sewage flow and BOD_5 discharge in Conneaut may cause some degradation of water quality in Conneaut Harbor and the mouth of Conneaut Creek. Part of the increase may be offset by improved pumping capacity which would reduce combined sewer overflow, and by other potential improvements in the sewage collection systems.

4.726
The annual input of BOD_5 to Lake Erie from Conneaut Creek was estimated to be 400 tons per year. (4-56) The estimated increase in sewage BOD_5 resulting from the proposed development is 10 tons per year, roughly 2.5 percent of this annual loading. This would lead to slight degradation of waters at the creek mouth and in the harbor. Altered land use patterns may lead to increased runoff and sediment loads for the Conneaut Creek watershed. Most of this sediment load would settle in Conneaut Harbor, with a minor impact on the open-lake waters. The resulting increases in BOD_5 loading cannot be accurately projected. Ashtabula Harbor is projected to receive an increase in the discharge of BOD_5 of 21 tons per year from the Ashtabula Sewage Treatment Plant. The estimated BOD_5 load of the Ashtabula River is estimated at 200 tons per year, so the increase is roughly

11 percent of the present loading. Slight decreases in the DO content of the Ashtabula Harbor may result from such an increase in sewage effluent. Changes in land use in the Ashtabula River basin are expected to be less extensive than in the Conneaut Creek basin. The increase in sewage effluent from the city of Ashtabula is therefore expected to be the most significant cause of altered water quality in Ashtabula Harbor. The BOD_5 effluent from sewage treatment in the city of Erie is projected to increase by only 14 tons per year, an increase over projected effluent levels of less than 0.5 percent. The resultant effects on Presque Isle Bay and adjacent waters would be negligible. Any increases in urbanization will degrade the quality of runoff entering the lake via tributaries. Suspended solids, phosphorus, nitrate, and BOD_5 loading will increase as a result of uranization, and slight degradation of water quality is expected at the mouths of tributaries whose watersheds have experienced increased urbanization as a result of the proposed plant. The greatest development is expected in the Conneaut Creek, Raccoon Creek, Crooked Creek, and Elk Creek watersheds.

(2) Secondary Impacts on Inland Waters

4.727
The applicant expects population growth and commercial or industrial development that would be induced by the proposed project to have a negligible-to-minor impact on overall water quality in the streams and creeks in the Regional Study Area. Most of the growth and development is expected to be in the northern portion of Ashtabula County and the western portion of Erie County. The drainage basins which will be affected by the plant induced growth are shown in Figure 2-115. Negligible overall impacts are expected for the following basins: No. 1, small streams to Lake Erie; No. 2, Ashtabula River, No. 5, Pymatuning Reservoir, and No. 8, Walnut Creek and small streams to Lake Erie. Minor to moderate localized overall impacts are projected for the following basins: No. 3, small streams to Lake Erie, No. 4, Conneaut Creek, No. 6, Crooked Creek and small streams to Lake Erie, and No. 7, Elk Creek and small streams to Lake Erie. Drainage basin No. 6 contains Turkey Creek. The undisturbed drainage basin of this particular creek could suffer serious water quality degradation or habitat loss for the following reasons: (1) its proximity to the site of the proposed plant; (2) the presence of a significant amount of land available for development, (3) good transportation access (railroads, Interstate I-90, plus small roads), (4) possible heavy development of land immediately south of Interstate I-90; and (5) the absence of a centralized sewage treatment infrastructure in communities within the basin.

4.728
The nature of the secondary impacts, where present, include the following:

(1) The addition of contaminant loads (e.g., suspended solids) due to construction of houses, roads, and commercial establishments. This is mostly due to runoff.

(2) The addition of contaminant loads from runoff in newly developed areas.

(3) The addition of contaminant loads due to the discharge from sewage treatment plants.

(4) The addition of contaminant loads due to leachate from on-lot septic systems.

(5) Changes in stream flow characteristics due to altered runoff characteristics, ground water withdrawals, stream diversions, or dam and reservoir construction and operations.

Surface Runoff

4.729
The construction and operation of the proposed Lakefront Plant is expected to induce secondary development, primarily in the Principal Study Area. Rural or vacant lands would be converted to residential, commercial, industrial and other basically urban land usages to accommodate the needs of the incoming population. As a result of this development, the quality, quantity and dynamics of stormwater runoff from the affected areas would be altered. In general, the impacts of urbanization on stormwater runoff include:

(1) Increased Runoff Volume -- due to additional paved, roofed and exposed area

(2) Intensified Flows -- as long, winding natural waterways are replaced by shortened paved channels or pipes

(3) Altered Runoff Quality -- as runoff from rural and/or agricultural areas is replaced by runoff from urban areas, development and/or construction sites.

4.730
The extent of these impacts would be site-specific, and determined by the extent and nature of the development. The actual surface runoff

impacts of secondary development are described for two types of impact areas: site of development and regional drainage basin. The site of development impacts involve runoff in the vicinity of new subdivisions of areas of development. The regional drainage basin impacts, on the other land, are the averaged effects of development on runoff within a regional drainage basin and are not localized.

4.731
The site of development impacts linked to the proposed Lakefront Plant are expected to be fairly severe. Exact locations of these site-specific development areas are not known, although they are expected to occur largely within the Coastal Communities. The extent of impact would depend on a number of factors. Since storm sewer systems are found in only a few areas in the Coastal Communities Study Area, runoff from new development sites would most likely drain directly to the nearest small stream. Runoff from the development may constitute a sizeable fraction of the total flow of the receiving stream and thus, the impacts on surface water quality and flow may be great. Due to the low topographic relief of the terrain in the Coastal Communities, overland flow velocities would be generally very low and hence the ability of the flow to scour contaminants would be restricted. A similar effect is anticipated in those new subdivisions that are drained by open ditching rather than storm sewers. The impacts of plant-related development on runoff as averaged over regional drainage basins are expected to range from moderate to minimal. A general measure of the impact can be provided by population changes. Average annual population changes associated with secondary development in the Principal Study Area have been estimated in the use of the SIMPACT IV Model. These results and estimated baseline population changes were converted to population change in each drainage basin under the development projection shown in Table 4-327. The resulting projected population changes for the year 1990 are presented in Figure 4-103 and changes in population density are presented in Figure 4-104 for each drainage basin studied (see Figure 2-115). Projected population changes due to the proposed project are most significant when compared to baseline changes in those drainage basins nearest to the project site. Impact population increases are therefore expected to be greatest in Drainage Basin 3 (Small Streams into Lake Erie), and Drainage Basin 6 (Crooked Creek and Small Streams). Since Drainage Basin 4 (Conneaut Creek) is relatively large (approximately 190 square miles) and a majority of its area is expected to remain relatively undeveloped, plant-induced development impacts are not expected to be as great as in Basins 3 and 6.

4.732
As an additional measure of regional drainage basin impacts, an analysis based on the project-related secondary land use changes was

Table 4- 327

Development Scenario of Estimated Percentages of New Population/Development in Each Community by 1990(1) Allocated by Drainage Basin

Study Areas Drainage Basins	(1) Conneaut City	(2) Kingsville(2)	(3) Ashtabula	(4) Ashtabula City	(5) Saybrook	(6) Remainder of Ohio Principal Impact Area	(7) Springfield(3)	(8) Girard(4)	(9) Fairview	(10) Millcreek	(11) Remainder of Pa. Principal Impact Area
1. NW Ashtabula County, Lake Erie-Small Streams	-	-	-	-	95%	-	-	-	-	-	-
2. Ashtabula River	-	5%	50%	100%	5%	35%	-	-	-	-	0%
3. N-Central Ashtabula Co., Lake Erie-Small Streams	50%	80%	50%	0%	-	-	-	-	-	-	-
4. Conneaut Creek	50%	15%		-	-	5%	5%	-	-	-	20%
5. Pymatuning Lake	-	-	-	-	-	30%	-	-	-	-	20%
6. Crooked Creek and Small Streams-Lake Erie	0%	-	-	-	-	-	95%	20%	-	-	20%
7. Elk Creek and Small Streams-Lake Erie	-	-	-	-	-	-	0%	80%	20%	-	20%
8. Walnut Creek and Small Streams-Lake Erie	-	-	-	-	-	-	-	-	70%	60%	20%
Other	-	-	-	-	-	30%	-	-	10%	40%	0%

(1) *Applied during analysis to both estimated* baseline population and projected secondary growth linked economically to the proposed Lakefront Plant.

(2) Includes North Kingsville *Village and* Kingsville Township.

(3) Includes East Springfield Borough and Springfield Township.

(4) Includes Girard and Platea Boroughs and Girard Township.

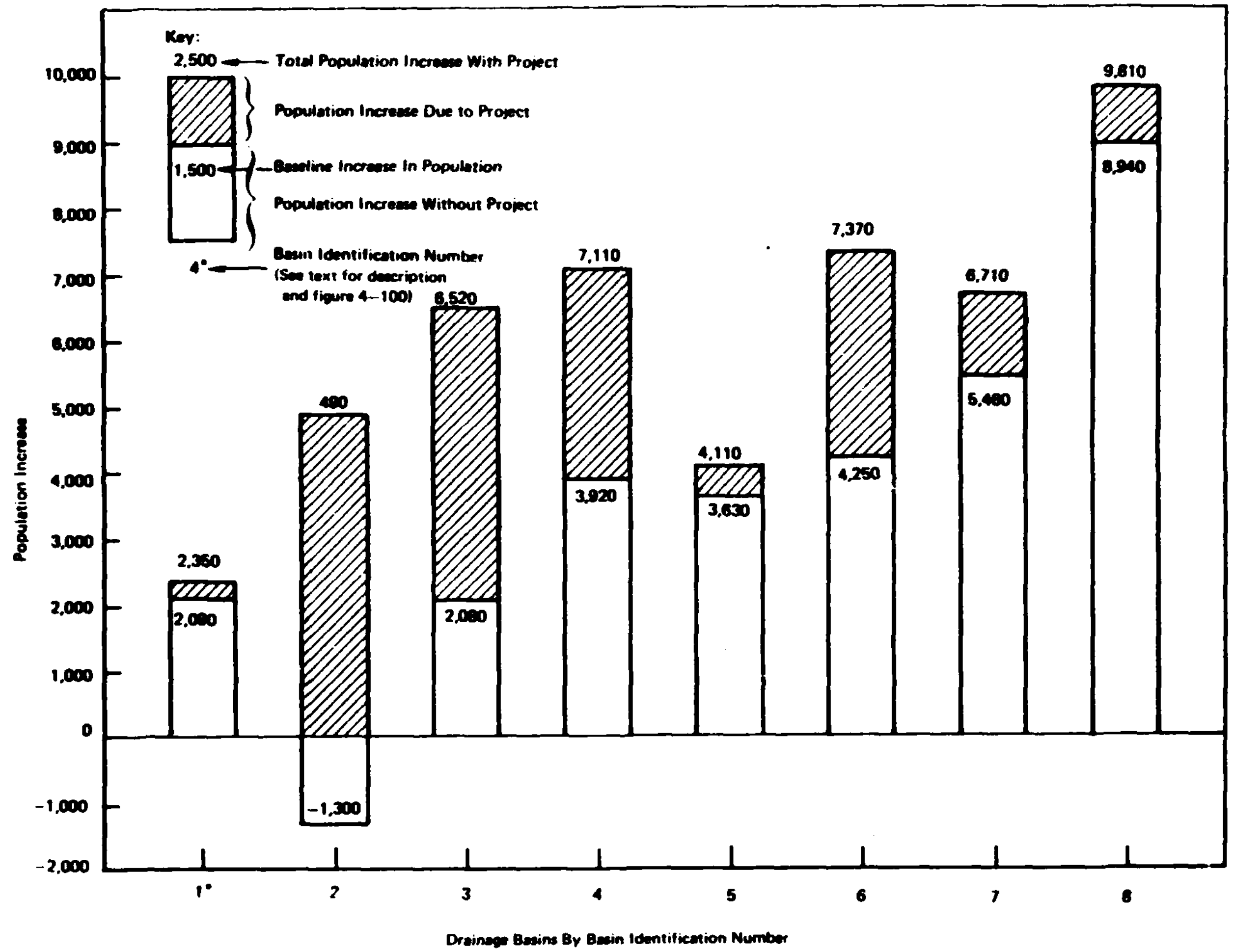


FIGURE 4– 103 PROJECTED POPULATION INCREASES BY 1990
IN VARIOUS DRAINAGE BASINS IN THE REGIONAL STUDY AREA

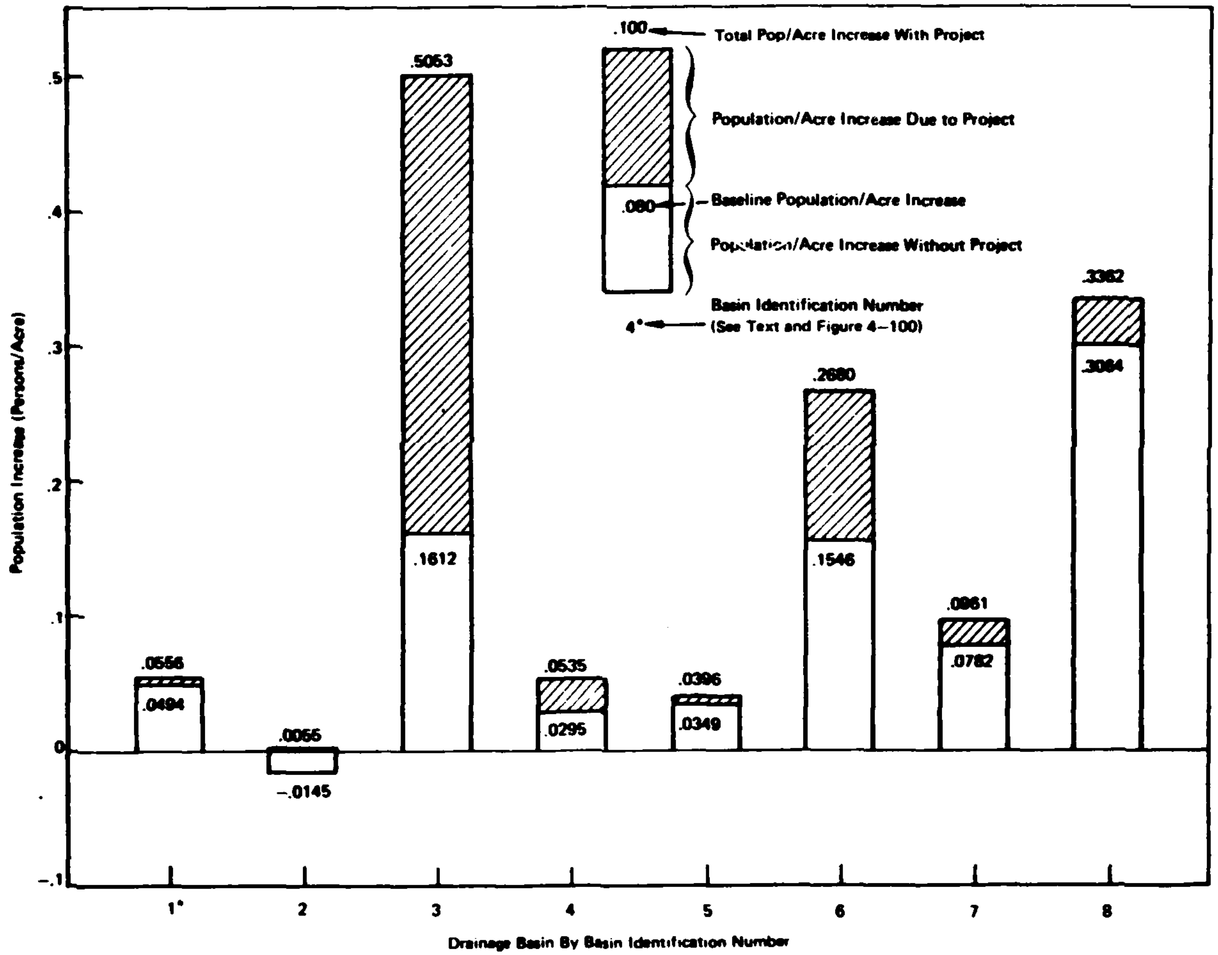


FIGURE 4– 104 PROJECTED PER ACRE POPULATION INCREASES BY 1990 IN VARIOUS DRAINAGE BASINS IN THE REGIONAL STUDY AREA

undertaken by the applicant. The results of this analysis indicate that, at worst only minor (less than 1.0 percent) increases in average annual runoff are expected, although increases in peak flows associated with storm events may be greater. The loadings of some contaminants, including lead, copper, chromium, and possibly fecal coliform, iron, and zinc may increase by as much as 10-20 percent in certain drainage basins by 1990 (due to plant-related activity). Loadings of suspended solids due to erosion from Lakefront Plant-related construction sites are not likely to be regionally significant, even during the years of heavy secondary development construction activities. In the most heavily impacted drainage basins, runoff from construction sites would account for less than five percent of the total projected suspended solids loadings in 1985.

4.733
When baseline changes in land use are also considered, then the total worst case impacts might be 100 percent greater (overall) than those listed above.

4.734
The regional runoff quality impacts projected here are considered tentative. There was insufficient local runoff data to project the changes in contaminant loadings with any degree of accuracy.

Drainage

4.735
The effects of urbanization of the flow dynamics of stormwater drainage have been well documented. (4-57, 4-58) Buildings, streets and other urban land coverings inhibit the access of precipitation to the soil, increasing runoff volumes. (4-59) Additionally, the dynamics of the drainage process are altered by urbanization. Comparative studies (4-60) of urban versus rural drainage basins indicate that the storm flow in urban basins often is concentrated in sharper, shorter, and higher peaks. The effects of urbanization were observed to be most pronounced during the smaller, more frequent storm occurrences.

4.736
The primary pollutant in runoff from agricultural or rural lands, is eroded sediment. This material along with degradation products of herbicides, pesticides, fertilizers, and/or animal and plant wastes are introduced to the drainage. As an area is urbanized, land use changes affect the nature of the runoff. During construction, erosion rates can increase greatly as vegetation is removed, subsoil is exposed to the action of wind and rain, and topography is changed.

Stormwater runoff from construction sites can transport eroded material along with miscellaneous construction debris and other contaminants (e.g., spilled fuel). Once construction is completed, erosion rates decrease in areas where revegetation of exposed land occurs. Urban runoff will be polluted by street litter containing animal feces (BOD and pathogens), corrosion from buildings and their appurtenances (metals), pollutants from automobile emissions and corrosion (heavy metals, asbestos, slowly biodegradable petroleum products) and deicing compounds (chlorides). An analysis incorporating the results of the SIMPACT IV Model was conducted to quantify the effects of baseline and plant-induced urbanization on the volumes of stormwater runoff within regional drainage basins in the Principal Study Area.

4.737
Since a runoff analysis is conducted by drainage basin as opposed to a socio-economic impact area, a method of allocating the projected development in each community to the various drainage basins was used. The demand for paved and built-on land in each drainage basin was then assumed to be proportional to the population influx. In this manner, baseline estimates of new paved and built land were obtained. Factors developed in the Stormwater Runoff Volume Working paper were then utilized to calculate the effect of the baseline and impact changes on runoff volume. It was predicted that Drainage Basin No. 3 would be the most severely impacted. Although the average annual increase in runoff in the entire basin is expected to be 1.5 percent or less, impacts at the site of development are expected to be severe. In estimating land use changes, the applicant assumed that 50 percent of the new residential land would constitute basically urban acreage and the resulting 50 percent will be characterized as rural land. Due to the difficulty of characterizing runoff from industrial areas and the relatively minor projected secondary growth in this sector, industrial land demands were not included in this analysis.

4.738
Changes in annual pollutant loadings to local surface waters implied by the changing land use were calculated. This calculation was based on the contaminant loading factors presented in Table 4-328. These factors were derived from nationwide data while the loading factors for rural land areas were based on runoff data obtained at Turkey Creek during one storm event. It is important to note that these factors are very approximate and the analysis has a very wide margin of error. It is not known whether the nationwide averages used would be applicable to the urban areas within the Principal Study Area. Urban contaminant loadings have been observed to vary by orders of magnitude from one place to another. The rural land loadings,

Table 4- 328

Typical Pollutant Loadings
(pounds/acre/year)

	Commercial Land(1)	Other Urban Land(1)(2)	Rural Land(3)
Total Solids	3400	7100	2700
Total Nitrogen	20	40	3
Total Phosphorus	3	7	1.5(a)
BOD_5	200	140	>25
COD	900	100	230
Fecal Coliform (col/liter)	$2X10^{12}$	$5X10^{12}$	$>2X10^{6}$
Zinc	2	2	0.6
Copper	0.4	0.7	0.04
Lead	10	6	< 0.1
Iron	70	150	20
Chromium	0.7	1.0	<0.04
Cadmium	0.01	0.02	<0.04

(1) Based on nationwide data

(2) Excludes industrial lands. Pollutant loadings of industrial lands have been observed to be highly variable.

(3) Estimated from runoff data obtained at Turkey Creek.

(a) PO_4 phosphorous only

Source: Arthur D. Little, Inc. estimates, "Water Quality Management Planning for Urban Runoff," United States Environmental Protection Agency, EPA-440/9-75-004, Washington, D.C.

although estimated from local data, are based on only one storm event and hence are of limited reliability. Use of contaminant loading factors based on only three land use categories reflects a simplified analysis that is a product of the poor quality of the available baseline data. The results of the rough analysis of the impacts of the proposed Lakefront Plant-related development on runoff averaged over regional drainage basin are presented in Tables 4-329 through 4-336.

4.739
The impacts presented in Tables 4-329 through 4-336 may be summarized as follows:

- The loadings of all the contaminants studied are expected to increase, with the possible exception of COD.
- The most severe Lakefront Plant-related impacts are expected in 1990 in Drainage Basins 3 and 6 where loadings of chromium, lead, and copper are expected to increase by 10-20 percent as a result of Lakefront Plant-linked growth.
- The most severe total impacts (Lakefront Plant-linked plus baseline) are expected in Drainage Basin 6, the Crooked Creek area, and Drainage Basin 8, the Walnut Creek area, where loadings of lead, copper, and chromium might increase by as much as 25-50 percent in 1990. Coliform, zinc, and iron are also expected to increase significantly in these basins.

4.740
The analysis does not include the impacts of Lakefront Plant-linked construction activities in the Principal Study Area. Heavy construction activities associated with secondary development are expected in both 1981 and 1985. In an independent analysis, the total suspended solid loadings resulting from the induced construction activities were calculated. In the analysis, it was assumed that construction would commence 1.75 years prior to the time of demand and would be accompanied by erosion rates of 20 tons per acre. These erosion rates are estimated to be typical of uncontrolled construction sites in this relatively flat region. The results of this analysis are presented in Table 4-337. Site of development impacts due to erosion on Lakefront Plant-related construction sites may be severe.

Sewage Disposal

4.741
The portion of the expected population increase that will occur in sewered areas versus nonsewered areas will depend on several factors including soil drainage characteristics (generally poor in the study area), the capacity of existing sewage treatment plants to handle additional loads, the availability of funds to add new sewage treatment (and collection) capacity, and local zoning ordinances.

Table 4- 320

Estimated Contaminant Loading Changes Related to the Lakefront Plant -- by Drainage Basin (tons/year)

Contaminants	Current[1]	Drainage Basin 1 (Small Streams into Lake Erie) Cumulative Changes[2] 1981	1985	1990
Total Solids	65,000	+50	+100	+150
Total Nitrogen	150	+0.5	+0.8	+1
Total Phosphorus	>40	+<0.07	+<0.1	+<0.15
BOD_5	>750	+<1.5	+<2.5	+<3.5
COD	5,000	-1.5	-3.0	-4.0
Fecal Coliforms[3]	$>10^{16}$	$+<10^{14}$	$+<10^{14}$	$+<10^{14}$
Zinc	15	+0.02	+0.03	+0.04
Copper	1-2	+0.01	+0.015	+0.02
Lead	15	+0.08	+0.15	+0.15
Iron	650	+1.5	+3.0	+4.0
Chromium	2-3	+0.01	+0.02	+0.03

(1) Does not include loadings from livestock wastes or combined sewer overflows.

(2) Does not include baseline contaminant changes, estimated in this drainage basin to be approximately 8.0 times the Lakefront Plant-linked changes. Loadings due to changes in industrial land use were not not included, due to the great variability in the quality of runoff from industrial lands.

(3) Colonies per year.

Source: Arthur D. Little, Inc. estimates.

Table 4- 330

Estimated Contaminant Loading Changes Related to the Lakefront Plant -- by Drainage Basin (tons/year)

		Drainage Basin 2 (Ashtabula River)		
		Cumulative Changes[2]		
Contaminants	Current[1]	1981	1985	1990
Total Solids	130,000	+60	+150	+250
Total Nitrogen	200	+0.6	+1	+2
Total Phosphorus	>80	+<0.08	+<0.2	+<0.3
BOD_5	>1400	+<2	+<4	+<6
COD	10,000	-1.5	-4	-6
Fecal Coliforms[3]	$>10^{16}$	$+<10^{14}$	$+<10^{14}$	$+<10^{15}$
Zinc	30	+0.02	+0.05	+0.08
Copper	1.5-3	+0.01	+0.02	+0.04
Lead	15-20	+0.1	+0.2	+0.3
Iron	1200	+2	+4	+7
Chromium	2-4	+0.02	+0.03	+0.05

(1) Does not include loadings from livestock wastes or combined sewer overflows.

(2) Does not include baseline contaminant changes, estimated in this drainage basin to be negligible. Under baseline and impact conditions, future loadings would be as great as projected here. Loadings due to changes in industrial land use were not included, due to the great variability in the quality of runoff from industrial lands.

(3) Colonies per year.

Source: Arthur D. Little, Inc. estimates.

Table 4- 331

Estimated Contaminant Loading Changes Related to the Lakefront Plant -- by Drainage Basin (tons/year)

		Drainage Basin 3 (Small Streams into Lake Erie)		
		Cumulative Changes[2]		
Contaminants	Current[1]	1981	1985	1990
Total Solids	23,000	+150	+350	+600
Total Nitrogen	70	+1	+3	+5
Total Phosphorus	>15	+<0.2	+<0.4	+<0.8
BOD_5	>300	+<4	+<10	+<20
COD	1500	-1	-3.5	-7
Fecal Coliforms[3]	$>10^{16}$	$+<10^{14}$	$+<10^{15}$	$+<10^{15}$
Zinc	6	+0.04	+0.1	+0.2
Copper	1	+0.02	+0.06	+0.1
Lead	9	+0.2	+0.5	+1
Iron	300	+4	+10	+20
Chromium	1.5	+0.03	+0.68	+0.15

(1) Does not include loadings from livestock wastes or combined sewer overflows.

(2) Does not include baseline contaminant changes, estimated in this drainage basin to be approximately 0.5 times the Lakefront Plant-linked changes. Loadings due to changes in industrial land use were not included, due to the great variability in the quality of runoff from industrial lands.

(3) Colonies per year.

Source: Arthur D. Little, Inc. estimates.

Table 4- 332

Estimated Contaminant Loading Changes Related to the
Lakefront Plant -- by Drainage Basin
(tons/year)

Contaminants	*Current*[1]	Drainage Basin 4 (Conneaut Creek) Cumulative Changes[2] 1981	1985	1990
Total Solids	190,000	+70	+200	+400
Total Nitrogen	250	+0.7	+2	+3.5
Total Phosphorus	>100	+<0.1	+<0.25	+<0.5
BOD_5	>2000	+<2.5	+<6.5	+<12
COD	15,000	+0.25	-0.35	-2
Fecal Coliforms[3]	$>10^{16}$	$+<10^{14}$	$+<10^{14}$	$+<10^{15}$
Zinc	40	+0.03	+0.07	+0.15
Copper	1-4	+0.01	+0.03	+0.06
Lead	10-20	+0.15	+0.35	+0.65
Iron	1500	+2.5	+6	+12
Chromium	2-4	+0.02	+0.05	+0.1

(1) Does not include loadings from livestock wastes or combined sewer overflows.

(2) Does not include baseline contaminant changes, estimated in this drainage basin to be approximately 1.2 times the Lakefront Plant-linked changes. Loadings due to changes in industrial land use were not included, due to the great variability in the quality of runoff from industrial lands.

(3) Colonies per year.

Source: Arthur D. Little, Inc. estimates.

Table 4- 333

Estimated Contaminant Loading Changes Related to the Lakefront Plant -- by Drainage Basin (tons/year)

Contaminants	Current[1]	Drainage Basin 5 Pymatuning Reservoir Cumulative Changes[2] 1981	1985	1990
Total Solids	140,000	+40	+80	+120
Total Nitrogen	200	+0.4	+0.7	+1
Total Phosphorus	>80	+<0.05	+<0.1	+<0.15
BOD_5	>1500	+<1	+<2	+<3
COD	12,000	-1	-2.5	-3.5
Fecal Coliforms[3]	$>10^{16}$	$+<10^{14}$	$+<10^{14}$	$+<10^{14}$
Zinc	30	+0.01	+0.03	+0.04
Copper	0.5-2.5	+0.007	+0.01	+0.02
Lead	6-10	+0.06	+0.1	+0.2
Iron	1,000	+1	+2.5	+3.5
Chromium	1-3	+0.01	+0.02	+0.03

(1) Does not include loadings from livestock wastes or combined sewer overflows.

(2) Does not include baseline contaminant changes, estimated in this drainage basin to be approximately 7.6 times the Lakefront Plant-linked changes. Loadings due to changes in industrial land use were not included, due to the great variability in the quality of runoff from industrial lands.

(3) Colonies per year.

Source: Arthur D. Little, Inc. estimates.

Table 4- 334

Estimated Contaminant Loading Changes Related to the Lakefront Plant -- by Drainage Basin (tons/year)

		Drainage Basin 6 (Crooked Creek and Small Streams into Lake Erie)		
		Cumulative Changes[2]		
Contaminants	Current[1]	1981	1985	1990
Total Solids	39,000	+80	+200	+450
Total Nitrogen	60	+0.7	+2	+4
Total Phosphorus	>25	+<0.1	+<0.3	+<0.6
BOD_5	>400	+<2	+<6	+<12
COD	3,000	-1.5	-5	-10
Fecal Coliforms[3]	$>5x10^{15}$	$+<10^{14}$	$+<5x10^{14}$	$+<10^{15}$
Zinc	9	+0.03	+0.07	+0.15
Copper	0.3-0.9	+0.01	+0.04	+0.07
Lead	3-4.5	+0.1	+0.3	+0.65
Iron	340	+2	+7	+13
Chromium	0.5-1	+0.02	+0.05	+0.1

(1) Does not include loadings from Livestock wastes or combined sewer overflows.

(2) Does not include baseline contaminant changes, estimated in this drainage basin to be approximately 1.4 times the Lakefront Plant-linked changes. Loadings due to changes in industrial land use were not included, due to the great variability in the quality of runoff from industrial lands.

(3) Colonies per year.

Source: Arthur D. Little, Inc. estimates.

Table 4- 335

Estimated Contaminant Loading Changes Related to the Lakefront Plant -- by Drainage Basin (tons/year)

		Drainage Basin 7 Elk Creek (Small Streams into Lake Erie)		
		Cumulative Changes[2]		
Contaminants	Current[1]	1981	1985	1990
Total Solids	100,000	+70	+150	+250
Total Nitrogen	150	+0.6	+1	+2
Total Phosphorus	>60	+<0.08	+<0.2	+<0.3
BOD_5	>1,000	+<2	+<4	+<7
COD	8,000	-2	-4	-7
Fecal Coliforms[3]	$>10^{16}$	$+<10^{14}$	$+<10^{14}$	$+<5x10^{15}$
Zinc	20	+0.02	+0.05	+0.08
Copper	1-2	+0.01	+0.02	+0.04
Lead	10	+0.1	+0.2	+0.4
Iron	900	+2	+4.5	+7.5
Chromium	1.5-2.5	+0.02	+0.03	+0.06

(1) Does not include loadings from livestock wastes or combined sewer overflows

(2) Does not include baseline contaminant changes, estimated in this drainage basin to be approximately 4.4 times the Lakefront Plant-linked changes. Loadings due to changes in industrial land use were not included, due to the great variability in the quality of runoff from industrial lands.

(3) Colonies per year.

Source: Arthur D. Little, Inc. estimates.

Table 4- 336

Estimated Contaminant Loading Changes Related to the Lakefront Plant -- by Drainage Basin (tons/year)

Contaminants	Current(1)	Drainage Basin 8 (Walnut Creek and Small Streams into Lake Erie) Cumulative Changes(2) 1981	1985	1990
Total Solids	45,000	+100	+200	+300
Total Nitrogen	100	+1	+1.5	+2.5
Total Phosphorus	>30	+<0.1	+<0.2	+<0.4
BOD_5	>550	+<3	+<5	+<8
COD	3,000	-3	-5	-9
Fecal Coliforms(3)	$>10^{16}$	$+<10^{14}$	$+<10^{14}$	$+<10^{15}$
Zinc	10	+0.03	+0.06	+0.1
Copper	1-1.5	1.02	+0.03	+0.05
Lead	10	+0.1	+0.3	±0.4
Iron	500	+3	+6	+9
Chromium	1.5-2	+0.02	+0.04	+0.07

(1) Does not include loadings from livestock wastes or combined sewer overflows.

(2) Does not include baseline contaminant changes, estimated in this drainage basin to be approximately 10 times the Lakefront Plant-linked changes. Loadings due to changes in industrial land use were not included, due to the great variability in the quality of runoff from industrial lands.

(3) Colonies per year.

Source: Arthur D. Little, Inc. estimates.

Table 4- 337

Sediment Loadings in Runoff Due to Lakefront Plant-Linked Construction Activities (tons/year)

		Additional Loadings[1]	
	Current	1981	1985
Drainage Basin 1	65,000	-	-
Drainage Basin 2	130,000	+ 80	+ 200
Drainage Basin 3	23,000	+700	+1000
Drainage Basin 4	190,000	+700	+ 700
Drainage Basin 5	140,000	-	+ 20
Drainage Basin 6	39,000	+900	+ 800
Drainage Basin 7	100,000	+160	+ 200
Drainage Basin 8	45,000	-	+ 200

(1) Includes only those loadings related to the Lakefront Plant; does not include baseline loadings; not cumulative.

Source: Arthur D. Little, Inc. estimates.

4.742
The population in the Principal Study Area is expected to be about 339,000 in 1979. Approximately 67 percent of this population is presently sewered, and most of the treated sewage is discharged to Lake Erie (primarily from the larger towns near the lake shore). The baseline increase in population by 1990 is expected to be about 23,800, while an additional 15,400 would be expected as a result of the proposed project. Thus, the impact-related increase (15,400) is 4.0 percent of the total population expected, with the project, in 1990 (387,300). Approximately 93 percent of the total increase in population expected by 1990 is projected to fall into one of the eight drainage basins shown in Figure 2-115. The remainder, an increase of 2,900, due to both project and baseline increases, would be widely spread over other drainage basins to the east, south, and west.

4.743
Under normal conditions, it is expected that the greatest population increases would occur in areas that are, or are expected to be, served by municipal sewers and waters. This may not happen in areas where services are already overloaded, or where funding is not available for needed expansion. In the latter case, the expected population increases may be less than those predicted and a greater proportion of houses with their own wells and on-lot septic systems, will result. Some developments may be allowed to use small, packaged treatment systems. Assuming no serious impediments or delays in the availability of required funding, it is further assumed that a very high percentage of the 1990 population will reside in sewered areas. In fact, all major subdivisions (i.e., cities and townships) except Springfield, Pennsylvania, and "Other parts of the Ohio Principal Study Area," could have 90-100 percent of their population sewered. Springfield is assumed to be 70 percent sewered, and "Other Ohio Principal Areas," 60 percent sewered by 1990. In both baseline and plant-induced development areas, a significant increase in the percentage of population sewered is assumed. Thus, in both cases, a significant increase in discharges (i.e. volume of water and contaminants discharged) from municipal wastewater treatment plants would be expected. The effect of the proposed project would be to increase these discharges, to a moderate degree, above what would otherwise be expected.

4.744
The situation in Springfield deserves some special attention. This area has no present plans for the installation of sewers or a treatment plant and, under plant-related impact, is not expected to have any sewage treatment facility until about 1985. The applicant's consultant estimated that the town may be 30 percent sewered by 1985

with a subsequent increase to 70 percent by 1990. Relatively heavy development pressure may be expected in this area because of its proximity to the proposed plant and the availability of land. Packaged treatment plants might offer an alternative to on-lot septic systems where soil conditions do not allow the operation of on-lot septic systems although it is not known whether or not such facilities will be allowed. The only surface waters that could be used as receiving waters (excluding those developments close enough to use Lake Erie) are Raccoon Creek and Crooked Creek. At present both of these streams have one point source discharge: a service station has a discharge to Crooked Creek and a truck stop has a discharge to Raccoon Creek. Raccoon Creek may not be suitable for additional point source discharges because (1) it already has some problems with high bacterial levels and (2) public water-contact recreation takes place in the Creek and at the County Park at the mouth of Raccoon Creek. Crooked Creek, a "Conservation Area Stream," currently meets or exceeds all applicable water quality standards. Consequently, there may be some reluctance to allow any further discharges that would degrade the water quality.

4.745
A few number of small packaged treatment plants might be allowed if high levels of treatment (better than secondary) were specified. Both streams have relatively low flows, i.e., 0.74 m^3/sec and 0.31 m^3/sec (annual average) for Crooked Creek and Raccoon Creek respectively, and seven-day, 10-year low flows are probably around 0.03 m^3/sec and 0.01 m^3/sec, respectively. Thus, relatively little assimulative capacity is available.

4.746
The status of existing municipal sewage service in the Regional Study Area has been summarized elsewhere. Table 2-227 indicates that 89 percent (by volume) of municipal discharges in Ashtabula County and Erie County are assumed to go into Lake Erie, while the remaining 11 percent (7.2 MGD) are spread out over 11 different streams, with only Elk Creek receiving discharges from two towns.

4.747
Elk Creek receives discharges from Lake City and Girard, Pennsylvania. The treatment plants in both towns are relatively old and are exceeding, or approaching their design capacities. Thus, even though the project-related population increase expected in this basin area is relatively small (1,250 persons by 1990), a moderate-to-severe impact on the water quality in Elk Creek may be expected, unless plans of the Northwest Erie County Regional Sewer Authority are implemented. Under such a plan, a new regional treatment plant would be built (with discharge to Lake Erie) and the old plants

phased out. If this plan (or improvement to the existing facilities) is not undertaken quickly, then such mitigative measures as a moratorium on new sewer connections could be imposed to eliminate additional impacts on Elk Creek.

4.748
Municipal discharges to other streams in the Coastal Communities are relatively small in volume compared to the Lake Erie discharges. In addition, the areas served by these sewers are not expected to realize any significant population increases by 1990, as a result of the proposed project. Thus, the additional impact on the receiving streams is expected to be small or negligible. This does not imply that baseline or total population increases expected will not have a serious impact. On the contrary, several other communities in the Regional Study Area have waste treatment plants that are already at or over the design treatment capacity. These include the following:

Town	Discharge to
Andover, Ohio	Pymatuning Reservoir
Orwell, Ohio	Grand River Tributary
Albion, Pennsylvania	East Branch of Conneaut Creek
Waterford, Pennsylvania	LeBoeuf Creek
Union City, Pennsylvania	South Branch of French Creek
Corry City, Pennsylvania	Hare Creek
Conneaut Lake JMA, Pennsylvania	Conneaut Outlet
Conneaut Lake MA, Pennsylvania	Conneaut Creek
West Mead #2, Pennsylvania	French Creek
Fredericksburg, Pennsylvania	Cussawego Creek

4.749
Impacts on surface waters due to seepage from on-lot septic systems are expected to be the greatest where large numbers of such systems are installed in a relatively small area. This appears to be possible in three drainage basins: No. 3, Small Streams to Lake Erie, No 6, Crooked Creek and Small Streams to Lake Erie, and, No. 8, Walnut Creek and Small Streams to Lake Erie.

4.750
The population increases expected by 1990, (baseline plus impact), in terms of persons per acre in each drainage basin, are 0.50, 0.27 and 0.34 for basins 3, 6, and 8, respectively. All other projected increases are below 0.1 persons per acre. However, the projected Lakefront Plant induced impact on Basin No. 8 is small, not only in absolute magnitude, but also in comparison with the baseline increase. If it is assumed that a large fraction of the developed area in this basin will be sewered by 1990, project-related impacts on surface waters due to seepage from on-lot septic systems in Basin No. 8 would be negligible.

4,751
In Basins No. 3 and 6, the projected plant induced increase in population per acre is significant. In addition, a substantial portion of the developed land involved may not be sewered by 1990. For example, Springfield Township and East Springfield Borough (which are mostly in Basin No. 6) are not planning under baseline conditions to install sewage service by 1990. Similarly, substantial areas of Kingsville (mostly in Basin No. 3) are not expected to be sewered by 1990. If these factors combine to induce a significant amount of development with on-lot systems (or even packaged systems), then adverse impacts on nearby streams are possible.

Changes in Stream Flow Characteristics

4.752
Altered stream flow characteristics may result from excessive ground water withdrawals, altered runoff characteristics, stream diversions, or dam or reservoir construction.

4.753
New development in an area tends to increase surface runoff because of loss of wetlands and vegetation and the addition of roads and associated storm drains. Consequently, water reaches streams more rapidly than usual, resulting in initially higher flow rates after a rainstorm. Also, because less water enters the ground, ground water recharge of streams in both wet periods and in low-flow periods is reduced. In a few specific cases, one large development or one major, new road could significantly alter flows in small nearby streams.

4.754
Incremental groundwater withdrawals are not expected to have any serious impact on stream flows. In most cases where wells are used, the population density is low and most of the water is returned to the ground (e.g., via septic systems). Most of the population increase expected (with or without the project) would probably fall in areas currently served by municipal water supplies. Lake Erie water is used for water supply by all Coastal Communities in the Regional Study Area.

4.755
Serious alterations in stream flow characteristics could result from any stream diversion or dam or reservoir construction. These activities are usually related to community desires or needs for water supply, flood control, recreation, and (to a lesser degree in this area) irrigation.

4.756
There are at present several dams, in-stream reservoirs, and upground storage reservoirs, and the need for additional impoundments may increase along with any population growth. Stream diversions appear very much less likely in the foreseeable future than dams and reservoirs.

4.757
Impoundments resulting from dams or reservoir construction often regulate flow rates in the downstream segments (i.e., the peaks are reduced and low flows can be augmented). Reaeration rates in the impoundments are lowered (due to reduced mixing) and downstream segments may, be affected by reduced DO concentrations.

4.758
Stream flows in the Regional Study Area may experience a slight increase as a direct result of one aspect of the proposed plant operation. It is expected that various cooling towers at the proposed plant will emit about 3,700 m^3/hr of water into the atmosphere, in the form of water vapor and small droplets. If, for example, all this water fell as precipitation over a 10,000 square mile parcel of land, it would add ((0.05 inches) of rain to the natural rainfall. This would result in a 0.05 percent increase in rainfall and a (roughly) corresponding increase in runoff. However, the amount of increase depends on a number of climatological factors and cannot be accurately estimated on the basis of available data.

Water Supply Withdrawals

4.759
Within the Regional Study Area, the lake plain area underlain by glacial till and shale is a poor groundwater area with typical well yields of about 0.3 liter/sec (five gpm) or less. Only sands and gravel present in the form of beach ridges provide local sources of groundwater with yields of about 20 liters/sec (300 gpm). Elsewhere, unconsolidated sediments (outwash, kame and esker deposits) in present day and former valleys have potential for large-scale water development. As a result, only about 15 percent of the water used by municipal supply systems in the Regional Study Area is derived from wells and springs. The cities of Meadville and Titusville are the largest groundwater users because they overly valleys containing unconsolidated sediment. Development of new groundwater supplies due to increased population growth would, by nature of the baseline envrionmental conditions, occur only in those areas having aquifers capable of plentiful yields.

Effects on Water Use

4.760
Plant related impacts on baseline water uses in the Study Areas include the following:

- Increased withdrawal from Lake Erie or from groundwater sources to meet domestic, commercial, leakage requirements,
- Increased withdrawal from Lake Erie or groundwater sources to accommodate industrial and agricultural uses,
- Increased transport water uses for industrial purposes (cooling, waste, etc.),
- Increased water uses for recreation, navigation and flood control purposes.

4.761
An important parameter affecting some withdrawal uses (domestic, public/commercial, leakage and agricultural) is the population growth induced during both the construction and operation phases in the Local, Principal and Regional Study Areas.

4.762
Induced annual average municipal water requirements as a percentage of baseline projections are expected to peak in the Local, Principal, and Regional Study Areas during the construction year 1981. The impact may be also significant in the year 1986.

a) Withdrawal Water Use Impacts

4.763
Withdrawal uses expected to be affected are the Domestic, Public/Commercial and Leakage (DPL) water uses, the Agricultural water uses, and the Industrial water uses. Water is withdrawn from groundwater, surface water resources (streams, reservoirs) or Lake Erie. Private water supplies may be supplied from any of these sources.

Domestic, Public/Commercial, Leakage (DPL) Water Use Impacts

4.764
During construction, potable water at the site will be provided by the Contractors. The source of this water has not yet been determined. Since up to 10,500 workers may be on the site during peak phases of construction, primary water use may have an impact on local water supplies, although per capita use of potable water during construction has not been estimated. During plant operation, potable water will either be withdrawn from Lake Erie (and treated onsite) or, if possible, purchased from the city of Conneaut. The estimated

consumption of potable water during plant operations and its impact on local water supplies (if purchased) has not been determined but the applicant expects this impact to be minor. Secondary impacts upon the DPL baseline water uses are expected during the construction and the operation phases in the Local, Principal, and Regional Study Areas due to the population growth induced by the facility's presence. The aggregated DPL secondary water use impacts in the Local, Principal, and Regional Study Areas for both the construction and operations phases have been projected and are presented in Table 4-338. Estimates are derived by using population and water use baseline projections and impacted population projections (see Table 4-338). Projected impacts vary from minimal (1.6 percent in 1981 in the Regional Study Area) to significant (40.8 percent in 1990 in the Local Study Area). The additional DPL water requirement can be obtained from Lake Erie or groundwater. Since adequate water supply sources exist, the impacts would be primarily financial. For Springfield Township and East Springfield Borough, no central water supply system presently exists and a new water supply system will probably be required in the near future.

Agricultural Water-Use Impacts

4.765
Agricultural water uses include crop irrigation, lawn sprinkling (including golf courses, cemeteries, etc.), livestock watering, etc. Some of these activities are directly related to the population growth (e.g., golf course irrigation), while others are not (e.g., agricultural irrigation, livestock). Estimated baseline agricultural water requirements are listed in Table 2-385. The agricultural versus DPL water requirements ratio is expected to remain approximately constant in the years 1981-1990 of the baseline, and equal to approximately 0.43 for the Regional Study Area and 0.30 for the Principal Study Area. However, based on this assumption no reliable estimates can be given for the Local Study Area due to the paucity of baseline data. Primary impacts on agricultural baseline water uses in the Principal and Regional Study Areas are not expected. The impacts of secondary agricultural water use requirements (estimated as percentages of the DPL water use requirements) are given in Table 4-339. These estimates may be conservative as certain major types of agricultural activity are assumed to decline as population and industrial/commercial uses grow. Therefore, the applicant expects secondary impacts upon baseline during the construction and operation phases seem to be minor in the Principal and Regional Study Areas.

Industrial Water-Use Impacts

4.766
The operation activities of the proposed plant are expected to have some primary impacts on baseline industrial water uses in the

Table 4- 338

Domestic, Public/Commercial Leakage (DPL) Water Use Impact Projections--1975-1990
(MCGD)

Study Area	1975	1981				1986				1990			
	DPL - Baseline Water Use	DPL - Baseline Water Use	DPL - Impacted Total Water Use	DPL - Water Use Impact	Impacts Upon Baseline(1) (%)	DPL - Baseline Water Use	DPL - Impacted Total Water Use	DPL - Water Use Impact	Impacts Upon Baseline(1) (%)	DPL - Baseline Water Use	DPL - Impacted Total Water Use	DPL - Water Use Impact	Impacts Upon Baseline(1) (%)
Regional Study Area	56.24	58.65	59.63	0.98	1.6%	60.56	62.38	1.82	3.0%	62.08	64.14	2.06	3.3%
Principal Study Area	[illegible].89	42.36	43.33	0.97	2.3	43.71	45.47	1.76	4.0	44.79	46.74	1.95	4.3
Local Study Area	2.22	2.31	2.49	0.18	7.9	2.39	3.16	0.77	32.4	2.46	3.46	1.00	40.8

(1) Proportionate to population impacts.

Source: Environmental Research & Technology, Inc.

Table 4- 33?

Agricultural (A) Water Use Impact Projections--1975-1990(1)
(Million Gallons Per Day)

Study Area	1975	1981				1986				1990			
	A - Baseline Water Use	A - Baseline Water Use	A - Impact Total Water Use	A - Water Use Impact	Impacts Upon Baseline(2) (%)	A - Baseline Water Use	A - Impact Total Water Use	A - Water Use Impact	Impacts Upon Baseline(2) (%)	A - Baseline Water Use	A - Impact Total Water Use	A - Water Use Impact	Impacts Upon Baseline(2) (%)
Regional Study Area	17.27	24.05	24.45	0.40	1.6%	26.10	26.88	0.78	3.0%	27.74	28.66	0.92	3.3%
Principal Study Area	8.64	12.02	12.29	0.27	2.3	13.03	13.55	0.52	4.0	13.87	14.47	0.60	4.3

(1) Round Numbers
(2) Proportion to the population impacts.

Source: Arthur D. Little, Inc., estimates.

Principal and Regional Study Areas. Baseline industrial water uses in the Principal Study Area (see Table 2-385) has been estimated to total 225 MGD in 1975, 217 MGD in 1981, 203 MGD in 1986, and 192 MGD in 1990. Decreases in industrial water use result from expected increased recirculation of waste water, although total industrial output may increase. The proposed Lakefront Plant would require a water circulation rate of approximately 185,000 m^3/hr (1,173 MGD) under maximum operating conditions. This volume is broken down essentially into three categories: enclosed system cooling (22,200 m^3/hr (12 percent), indirect system cooling (88,800 m^3/hr (48 percent), process water (74,000 m^3/hr (40 percent). The plant would require a raw water intake of approximately 14,800 m^3/hr which is eight percent of the total usage. This water leaves the plant through cooling tower drift of 3,700 m^3/hr (23.5 MGD), cooling tower blowdown of 6,680 m^3/hr, and process bowndown of 4,420 m^3/hr. The plant discharge would be 11,000 m^3/hr and therefore, the water consumption would be $3{,}700^3$/hr (23.5 MGD) attributable to cooling tower and evaporation losses. Some of the evaporative loss (3,700 m^3/hr) may subsequently be returned to Lake Erie or the Great Lakes Basins through precipitation or decreased evaporation downwind. However, most of the evaporated water will probably be lost from the Great Lakes Basin, and therefore, the 3,700 m^3/hr must be considered as an actual consumption by the proposed Lakefront Plant. The primary operation impacts of the U. S. Steel plant upon the baseline industrial water consumption in the Principal Study Area would be (in percent): 11 percent in 1981, 11.6 percent in 1986, and 12.3 percent in 1990. The applicant has reported that total industrial water requirements along the Erie shore will decrease by 36 percent between 1970 and 2020. By the year 2000, manufacturing supplied by public systems in the United States will expand about 150 percent over the 1975 level of activity. However, it has projected that intake of water by manufacturers will decline about 55 to 60 percent by the year 2000. This is especially true for the industrial water supplied from public water systems. The International Joint Commission estimates that the consumptive use of water in the Great Lakes Basin will probably be 3,730 cfs (105 m^3/sec = 2,400 MGD) in year 2000. The proposed Lakefront Plant consumption represents one percent of the expected cosumption. The proposed closed system cooling water withdrawal of 22,300 m^3/hr will be returned to the lake with no consumptive losses.

b. Transport Water Use Impacts

(1) Power Cooling Water Use Impacts

4.767

Water withdrawn from both the United States and Canadian portions of Lake Erie for steam electric generation was 8,760 MGD in 1970

(consumption 72 MGD). Water withdrawn from Lake Erie for industrial cooling purposes was 3,867 MGD in 1970 (consumption 338 MGD). The total withdrawal therefore, for power cooling uses was 12,627 MGD in 1970, resulting in a consumptive use of 410 MGD (12,217 MGD were recirculated). In the Principal Study Area, 600 MGD in 1975 were required (Table 2-390). The indirect cooling system of the plant will require a total water recirculation rate of 563 MGD (88,800 m^3/hr). This rate corresponds to approximately 4.5 percent of the total power cooling recirculated withdrawal from Lake Erie in 1970.

Surface Runoff Impacts

4.768
The various cooling towers of the proposed plant will emit about 3,700 m^3/hr of water into the atmosphere in the form of water vapor and small droplets. For purposes of discussion, if all of this water fell as precipitation over a potential receiving area of 10,000 square miles it would theoretically add approximately 0.13 cm (0.05 inches) of rain to the natural rainfall which totals 100 cm/year. This would result in an insignificant secondary impact on the runoff transport water uses within the Regional as well as the Principal Study Area.

Impacts on Terrestrial Biota

4.769
Primary impacts of Facility Construction. In response to comments on the Draft EIS, the following analyses by the Corps staff is provided based on data supplied by Fahringer, McCarty, Grey, Inc., a consultant for the application. The ecological classification of flora seral ecotypes provided for the mitigation plan is the most recent and accurate inventory of floral communities. This information will be used in place of data analyzed for the Draft EIS. This change is made to enhance the quality of this report.

4.770
Construction of the proposed facility will require removal of approximately 1,766 acres of vegetation within the 2,800-acre Lakefront site. The acreage of various seral ecotypes in the impact area and percentage of the total impact area occupied by each of these ecotypes is shown on Table 2-400. Most of the vegetation to be removed during the construction phase lies in the area to the north of the Conrail tracks between Rudd Road and Thompson Road. A description of the area and flora seral ecotypes is included in the Terrestrial Environment Section of Chapter Two.

4.771
Most of the construction site is located on a poorly drained plain. Soil deposits overlie a clay and glacial till base. Soil condition and flora diversity along with good interspersion provide excellent habitat for ruffed grouse and woodcock as well as many warblers, finches, sparrows, and raptors. Pennsylvania Game Commission conducted inventories of the Pennsylvania segment (east of State Line Road) of the proposed site. The acreage of wildlife habitat loss for specific species is presented by ecotypes on Table 4-340. Although the majority of prime woodcock habitat would be destroyed during construction, some nesting areas will be left intact outside the construction area at the eastern and southern ends of the site. All of the snipe nesting areas identified during the onsite survey will be eliminated as construction proceeds, except for one site situated near State Line Road and the Norfolk and Western railroad tracks.

4.772
Woodcock nesting generally occurs on the site during the months of April, May, and June. If construction begins during this period, birds initially displaced may attempt to nest nearby until disturbed again by earthmoving equipment. Persistent use of the site by woodcock and the rapid clearing of habitat could result in total reproductive failure and increased adult mortality. The overall effect of such a loss must be weighed against the contribution the Lakefront site woodcock make to the regional population of this species.

4.773
Those woodcock leaving the site during the construction phase may utilize nearby habitat where the land surface drainage, soil texture, and vegetative cover are suitable. Such areas may be able to accommodate a few birds, but if they are at or near carrying capacity, overcrowding will result. Under these circumstances, competition for food and nesting sites will increase. If the total number of birds is great enough stress, starvation and disease could cause the decimation of the Lakefront population as well as the existing bird population prior to their influx. Further, birds already utilizing these areas may be forced into areas of low quality habitat where nesting success may be curtailed by increased predation or human activity.

4.774
During the fall migration period, woodcock from points further north would not be able to utilize the construction area. The sites specific geographic location along with its favorable habitat make the site of significant importance during this period. Pennsylvania Game Commission estimated the fall population to be 1,200 birds on its segment alone. These birds will have to utilize other habitat in the immediate area. The energy required for the crossing of Lake Erie

Table 4-340

Habitat Loss for Major Wild Bird and Mammal Species on Pennsylvania Segment of Proposed Site for U. S. Steel Lakefront Plant

Species	Major Habitat Types										Total Acres
	Aspen	Swamp/ Soft Maple	Hard Maple	Northern Hardwoods	Upland Oak	Altered Woodland	Thicket/ Swamp Thicket	Meadow/ Invaded Meadow	Lakeshore Bluff	Cultivated/ Grazed	
Woodcock	16.0	62.0	22.0	0.0	1.0	27.5	66.0	185.0	0.0	19.0	398.5
Ruffed Grouse	16.0	616.5	22.0	50.0	1.0	27.5	66.0	0.0	0.0	0.0	799.0
White-tailed Deer	16.0	616.5	22.0	50.0	1.0	27.5	66.0	185.0	0.0	19.0	1,003.0
Cottontail Rabbit	16.0	62.0	2.0	5.0	0.0	27.5	66.0	185.0	0.0	19.0	382.5
Fox Squirrel	0.0	0.0	22.0	50.0	1.0	27.5	0.0	0.0	0.0	0.0	100.5
Raccoon	0.0	616.5	22.0	50.0	1.0	27.5	66.0	0.0	0.0	0.0	783.0
Fox (Red and Gray)	16.0	616.5	22.0	50.0	1.0	27.5	66.0	185.0	0.0	19.0	1,003.0

Average Annual Impact of Habitat Loss on Major Wild Bird and Mammal Species on Pennsylvania Segment of Proposed Site for U. S. Steel Lakefront Plant

Species	Acres Habitat Lost	Fall Population Loss	Annual Population Loss	Kill Loss	Value Kill Loss	Hunter Man-Day Lost
					$	
Woodcock (Resident)	399	158	199	14	37.94	6
Woodcock (Migrating	399	1,200[1,2],	NA	54	146.34	23
Ruffed Grouse	799	197	295	40	367.60	135
White-tailed Deer	1,003	10	13	2	1,991.14	62
Cottontail Rabbit	383	273	1,199	46	1,134.82	54
Fox Squirrel	101	73	110	7	50.82	13
Raccoon	783	125	156	13	1,282.32	-
Fox (Red and Gray)	1,003	14	17	2	164.40	-
Totals	1,003	850[3]	1,990[3]	178	5,175.33	293

1 Read maximum fall population instead of fall population loss.

2 Density figures from Bennett and English (1947).

3 Resident only.

during the fall migration is considerable. These birds have adapted to take advantage of winds and other factors to reduce the energy required for the crossing. The expenditure of additional energy along with other factors such as crowding and the lack of suitable habitat may cause increased mortality among migrating birds. This would ultimately result in a reduction of woodcock populations in other geographic areas if migrating habitats are limiting.

4.775
Similar effects can be expected as populations of deer, fox, raccoon, squirrel, and rabbit are displaced from the Lakefront site. Since the habitat preferences are less restrictive compared to woodcock, these species would probably disperse into the undeveloped areas surrounding the Lakefront site. Survival of these individuals is dependent on the habitat carrying capacity and the availability of the food supply. In addition, wildlife moving to other areas must traverse roads, highways, and two major rail corridors before reaching suitable undisturbed habitat. Thus, the possibility of train or vehicle kills is increased.

4.776
In most cases, wildlife such as game species and other mammals and birds which are primary consumers (feed on vegetation) or occupy the lower trophic levels have high biotic potential. When suitable habitat is available, wildlife will be present at numbers approaching or exceeding the carrying capacity. If habitat is eliminated, such as is the case of the construction site, that population of wildlife will not be able to find new habitat and ultimately the result will be the permanent reduction of that population. Two other groups which would be adversely impacted during land clearing operations are the reptiles and amphibians. For the most part these individuals exhibit low mobility and would not be able to stay clear of the construction area. As a result, the majority of the herpete fauna occupying the 1766-acre construction zone would be lost.

4.777
Removal of the vegetation in the vicinity of Study Area No. 3 (refer to Chapter Two) would result in the loss of a stable flood plain forest consisting of swamp white oak which is relatively uncommon. In addition, two red maple trees, which exceed the Pennsylvania State record, will be removed during the land clearing process. One of these two is located near Study Area No. 9, while the other is situated near the intersection of Rudd Road and Childs Road.

4.778
Overall, the construction area contains some of the most productive habitat found on the Lakefront site. These include the Turkey Creek

ravine and the former Perry Bluff ore storage area. The area adjacent to Turkey Creek provides excellent habitat for mammals primarily because of the diversity of vegetation, abundant food supply, adequate cover, and the proximity to water. Removal of vegetation and subsequent filling of the creek ravine as originally proposed, would have eliminated this habitat and reduce the overall wildlife value of the upper watershed of Turkey Creek. Under the new proposal, the upper Turkey Creek watershed (above the vicinity of State Line Road) will be protected as a "greenbelt" and serve to buffer the upper watershed. This change will protect the integrity of the stream and its valuable adjacent habitat. The Perry Bluff area supports diverse bird, mammal, and herpetefauna populations primarily because of the diversity of early successional old field and shrub vegetation, the abundance of edge habitat (ecotone), and the number of standing water areas.

4.779
The nearshore area of Lake Erie and Conneaut Harbor are currently used by large numbers of resting and feeding waterfowl. Except for the intake and discharge structure, construction along the lake shoreline to the east of Conneaut Harbor will be largely confined to the area inland of Lake Road. Thus, only limited interference with nearshore waterfowl usage would be expected. In the harbor, construction of the pier and performance of dredging will interfere with waterfowl usage especially during spring and fall migration periods. Turkey Creek and the area immediately offshore would have been adversely affected if the creek was filled as formerly proposed. Under the new plan, the lower section of Turkey Creek would remain in a natural state. These areas would continue to provide resting and feeding areas for waterfowl.

4.780
At present the Lakefront site consists of a mixture of shrublands, woodlands, and grasslands which are well interspersed with one another. The edge effect or ecotone created along the perimeter of two adjoining habitat types provides excellent food and cover for wildlife. Once the construction phase gets underway most of the meadows, old fields and shrublands will be eliminated. The eventual result will be a steel plant surrounded by woodlands and some grasslands with many of the intermediate seral stages missing. Under these circumstances the habitat value of the site will be considerably less than that which exists at present. Although intermediate old fields and shrublands will be left intact along the eastern and southern perimeter of the site, it is not reasonable to expect that these areas will be able to accommodate wildlife displaced during the construction phase.

Site Preparation

4.781
The applicant's construction plans call for clearing, grubbing, and removal of onsite vegetation followed by grading to a specified elevation. Portions of the site where vegetation has been removed will be managed in accordance with Pennsylvania State Erosion Control Plan requirements. These requirements will apply to the entire site since the State of Ohio does not have an erosion control plan of its own. The applicant intends to protect open areas subject to runoff and erosion by seeding and mulching as soon as individual construction work phases are completed. In other areas where seeding is not practical, exposed areas will be covered with a layer of slag.

4.782
Two possible options are available for the disposal of vegetation. One involves the chipping of vegetation and the storage onsite for future sale. The second method considered more practical from the applicant's point of view is disposal by incineration. Emissions generated during this process could have a potentially harmful effect on local flora and fauna. In addition, burning of vegetation during the dry months of the year represents a fire hazard, which, if not properly controlled could cause the loss of large tracts of habitat downwind of the work site.

4.783
The Corps staff believes that the vegetation to be removed should be chipped. This vegetation, which will include root systems, is extremely high in nutrients and could be used for wildlife mitigation purposes. Poor habitat areas could be enhanced with this waste.

4.784
Topsoil removed during the site grading process will be stockpiled until the proposed Step I and Step II construction effort is completed. At the conclusion of the construction process, the soil will be redistributed and seeded. During the storage period (two-three years in Step I and two years in Step II), the soil will be subject to erosion by wind and water unless properly covered. Loss of topsoil would limit the success of the reseeding effort since the exposed subsoils will not readily support vegetation.

4.785
Movement of trucks or heavy earth moving equipment will generate dust and noise which will have a direct impact on the terrestrial habitat and the fauna it supports. Noise generated during the construction process could interrupt feeding or breeding patterns of wildlife while particulates in the form of dust could adversely effect the surrounding native vegetation.

4.786
The applicants original plan consisted of filling Turkey Creek for a distance of 1.5-2.0 miles above Lake Erie. The upper watershed would have been channeled and diverted to Conneaut Creek. This plan has been abandoned due to the adverse environmental impacts associated with its implementation. The present plan allows for the upper watershed above State Line Road to remain intact and to be permanently protected by a "greenbelt" area. The section of Turkey Creek below State Line Road is to be culverted through an 18-foot precasted concrete pipe. The culverted section would end 1,500 feet from Lake Erie. This 1,500-foot section will remain in a natural state for management and stream improvements to enhance fisheries. The culverted section which will be within the existing ravine will be filled and contoured to the upland plateau.

4.787
As a consequence of the filling process, one Turkey Creek flood plain would be permanently eliminated over the short and long-term. Plant communities which would be destroyed include the disturbed forest which exists along that portion of the creek between Lake Erie and the Bessemer and Lake Erie Railroad Bridge. The second community consists of a mixed mesophytic woodland stand which adjoins the creek channel between the B&LE Bridge and the Ohio State line.

4.788
Access roads will be constructed on the Lakefront site resulting in the short and long-term loss terrestrial vegetation and wildlife habitat. Temporary road construction would require the removal of vegetation and topsoil in order to achieve a stable base. When these roads are abandoned, secondary plant growth will invade the right-of-way creating an edge effect that will persist until the climax stage is reached. However, if the road bed does not receive any topsoil or conditioning prior to abandonment, invasion by secondary plant species will proceed very slowly. Under these conditions the land surface would be subject to the erosive effects of wind and rain for a longer period.

4.789
Permanent roads will be constructed. The installation methods and impacts would be the same as for temporary roads except that the road bed will be paved. During periods of heavy rainfall contaminated surface water runoff from the pavement may degrade the adjacent habitat especially if it contains standing water bodies or wetlands. The establishment of permanent road beds can alter surface drainage patterns. For example, if the road bed impedes surface water drainage terrestrial habitat may undergo conversion to wetland habitat. Conversely the installation of permanent roads with large drainage

culverts may cause existing wetlands to be drained. The applicant estimates that approximately 76 acres of the site will be permanently altered as a result of this type of road construction.

4.790
The same impacts are encountered with the establishment of plant railroad spurs. The main plant railroad spur will extend northward from the Bessemer and Lake Erie railroad line paralleling the permanent eastern plant access road. Land clearing along the spur right-of-way north of the B&LE will result in the elimination of a portion of the remnant hemlock-hardwood forest, which is the least common vegetative cover type on the Lakefront site. Approximately 21 acres of land will be permanently committed to the plant railroad spur. Although the flora in this area will be eliminated, an edge effect (ecotone) could develop between the rail spur right-of-way and the adjoining habitat. Such areas are able to support a diversity of wildlife. However, the noise and activity associated with the movement of railroad cars may deter the usage of the ecotone by wildlife.

Primary Impacts of Facility Operations

Impacts of Air Emissions

Sulfur Dioxide (SO_2) and Related Parameters

4.791
The effects of long term average emissions on human health, vegetation, and wildlife are important considerations both locally and downwind of the plant site. This discussion centers around the potential combined effects of plant emissions and background level concentrations over the long-term. The baseline and projected primary impact concentrations of selected air quality parameters is shown in Table 4-341. Sulfur Dioxide increments at various distances from the plant are shown in Figure 4-105. The information presented in the table and figure referenced above is based on ambient air quality monitoring conducted by the applicant's consultant and output from their air quality model.

Human Health Considerations

4.792
Sulfur Dioxide (SO_2). The results of the sampling program indicate annual mean SO_2 concentrations of 29-45 ug/m^3, depending on the location of the sampling site. Increments attributable to the plant added to background levels in this range would remain below the primary National Ambient Air Quality Standards, and below the levels of adverse health effects represented by those standards. Isopleths of

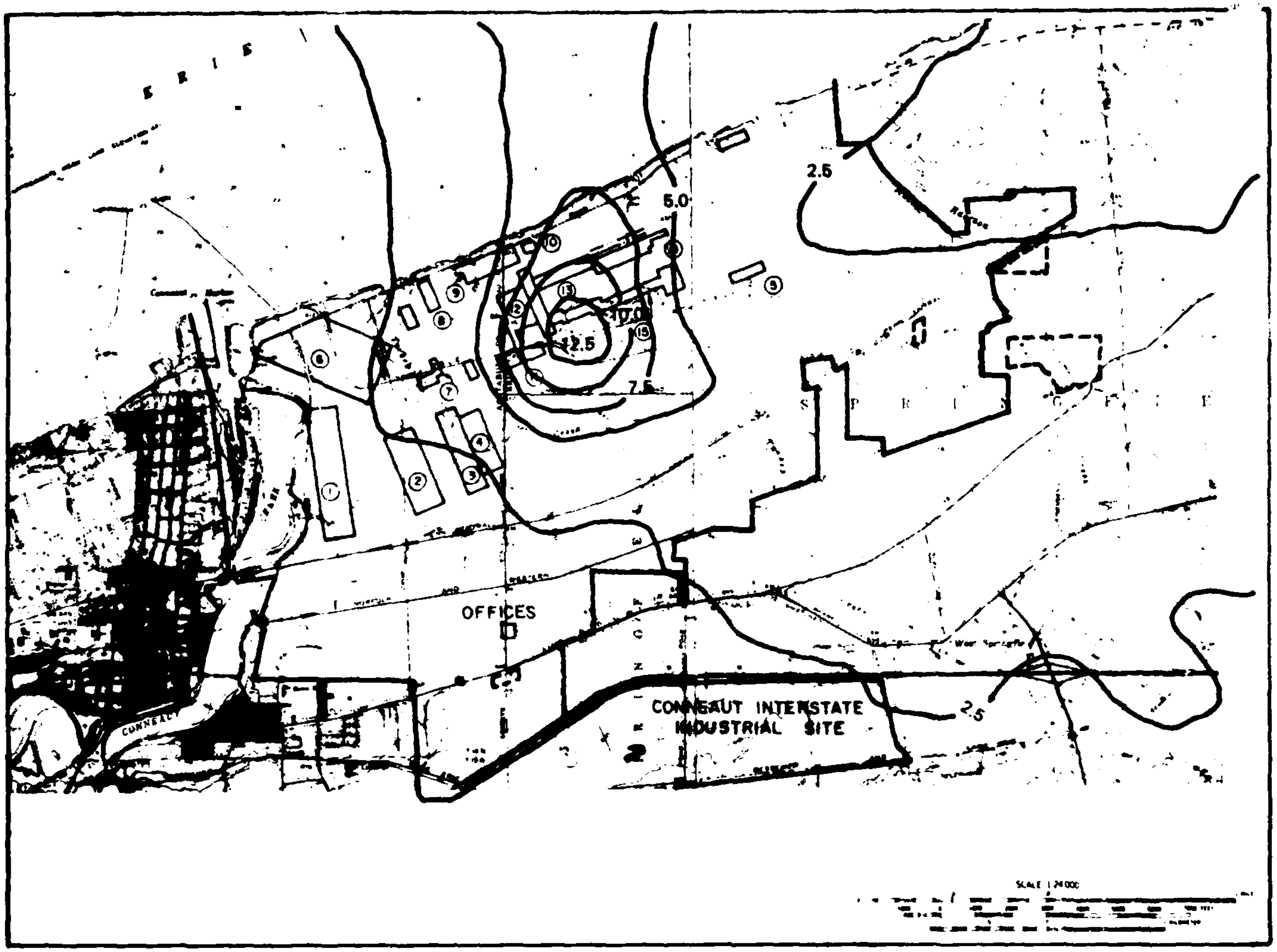
Table 4- 341

Baseline and Projected Primary Impact Concentrations of Air Quality Parameters on and Adjacent to the Proposed Site

	Baseline Ambient Concentration		Projected Plant Increment		Baseline and Projected Primary Impact Increment	
	24 hr. max. ($\mu g/m^3$)	Annual Mean ($\mu g/m^3$)	Worst Case 24 hr. max. ($\mu g/m^3$)	Maximum Annual Incr. ($\mu g/m^3$)	Worst Case 24 hr. max. ($\mu g/m^3$)	Annual Mean ($\mu g/m^3$)
SO_2	80-110 (1)	(29-45) (2)	33	12.5 (1) (7.5) (2)	160-190	41.5-57.5 (1) (36.5-52.5) (2)
SO_4	20	7-15	1-7 (3)	<0.1	21-27	7.1-15.1
Particulates	(135) (2)	(40-54) (2)	30	25 (1) (6) (2)	144 (4)	65-79 (1) (46-60) (2)
Ozone	350 (5)				350 (5)	
NO_2	(140) (2) 52 (1)	(46-52) (2)			(66 (6)) (2)	

(1)On Site.
(2)Off Site at property line.
(3)1-7 $\mu g/m^3$ is the range predicted to occur once in ten years, 1-6 $\mu g/m^3$ is predicted to occur once in two years; the locations at which predicted increments of 5-7 $\mu g/m^3$ are expected to be experienced are 20-50 kilometers downwind of the plant and less than 100 square kilometers in area (see the Air Quality Imports section of this chapter).
(4)Not a cumulative total -- see Air Quality Impact section of this chapter.
(5)One hour maximum, exceeds PRIMARY Standard.
(6)Total projected increase, all sources, 1985 (see the Air Quality Impact section of this chapter).

Source: Data collected on site by Environmental Research & Technology, Inc. and Air Quality baseline and impact sections of Chapters 2 and 4, respectively.



Source: MCDM Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates.

FIGURE 4–105 PROJECTED ANNUAL AVERAGE INCREMENT IN AMBIENT SO_2 CONCENTRATION FROM THE PROPOSED LAKEFRONT PLANT ($\mu g/m^3$)

the modeled average annual SO_2 increment show that the greatest increases in SO_2 concentration are expected in the immediate vicinity of stationary sources, and on the plant site. These increases are in the range of 5.0-12.5 ug/m^3. Offsite populated areas to the southeast might expect a 2.5-5.0 ug/m^3 annual average increase in SO_2 attributable to the plant.

4.793
Sulfate (SO_4). Background sulfate concentrations in the area are reported in the range of 7-15 ug/m^3. Maximum annual changes in sulfate concentration attributable to the plant are predicted not to exceed 0.1 ug/m^3, at a downwind distance of 30-100 kilometers. The increment added by the plant is low and in itself is not expected to constitute a health hazard. However, when combined with already high ambient levels the worst case and annual mean concentrations might be high enough to cause adverse effects. The USEPA has published best judgment threshold estimates for suspended sulfates which associate annual concentrations in the range 9-14 ug/m^3 with excess incidence of respiratory disease. (4-62) The California Air Resources Board (CARB) has utilized these EPA estimates in considering health benefits of sulfate reduction through use of alternative fuels in southern California. The CARB report indicates that asthma can be aggravated in the 6-10 ug/m^3 range when present in the atmosphere for 24 hours or more. Long-term exposure in the range 10-15 ug/m^3 increases the risk of chronic bronchitis. The EPA and CARB analysis of health effects is presented in Tables 4-342 and 4-343, respectively.

4.794
Both SO_2 and its atmospheric reaction products (i.e. acid and metallic sulfates) are substances which can adversely influence the health of individuals exposed to acute or chronic concentrations. At annual mean exposure levels of 90 ug/m^3 SO_2 the effects can reportedly be manifested as impairment of lung function. (4-62) Higher annual means in the range of 200 ug/m^3 are reportedly associated with increased frequency and severity of chronic lower respiratory disease. Currently, no national primary standard now exists for suspended sulfates, although the State of Pennsylvania has established its own standards, 30 ug/m^3 daily average, 10 ug/m^3 once in 30 days. Much of the experimental investigation of human physiologic response to SO_x has focused on SO_2. Some work has also been performed with respect to sulfuric acid (H_2SO_4). Fewer data are available on other particulate sulfates, such as the metallic or amminium sulfates. However, the health effects potential of some particulate sulfates is considered likely to exceed that of SO_2 at similar concentrations. Although health effects data for sulfates are still being studied, no national primary ambient standards have yet been set. Indications are that particulate sulfates

Table 4-342

Reported Threshold, Chronic, and Acute Effects Levels of Atmospheric Contaminants

Compounds	Human Response Thresholds: Level ($\mu g/m^3$)	Human Response Thresholds: Response	Health Effects Threshold — Acute: 24 hour: Level ($\mu g/m^3$)	Acute: 24 hour: Effect	Chronic: Annual Mean: Level ($\mu g/m^3$)	Chronic: Annual Mean: Effect
Sulfur Compounds						
Sulfur Dioxide	858-2,860	Taste, Odor	200-365	Aggravation of asthma/cardio-respiratory symptoms; mortality	90-200	Increased frequency of lower respiratory disease; reduced lung function
Sulfate			8-10	Aggravation of asthma/cardio-respiratory symptoms	9-14	Increased frequency of lower respiratory illness; increased prevalence chronic bronchitis
Sulfuric Acid	600-850	Taste, Odor, a wave				
Nitrogen Compounds						
Nitrogen Dioxide	3,000-3,800	Airway resistance			117-205	Decreased lung function, increased respiratory illness
Carbon Monoxide			$20-50 \times 10^3$	COHb levels: 3-5%		
Total Suspended Particulates			175-260[1]	Acute irritation; aggravation of asthma symptoms	90-120[1]	Decreased lung function, increased acute lower respiratory disease
Other						
Ozone	0.0002	Odor	0.00005-0.0005	Respiratory symptoms in hypersensitive individuals		

(1) United States Environmental Protection Agency, "Best Judgement Threshold Estimates for Health Effects." Furthermore "Health Effects of Particulates Pollution -- Reappraising the Evidence," a recent review by W.W. Holland, et. al, reported a "definite effect of air pollution on health" (long-term) at a TSP equivalent level of about 330 $\mu g/m^3$, in the presence of SO_2 levels of about 180 $\mu g/m^3$; and "increased illness discernible among bronchitic patients when 24-hour average concentrations exceeded. . . (TSP equivalent about 350 $\mu g/m^3$) with $[SO_2]$ of 500 $\mu g/m^3$.

Source: References 4-119 through 4-123.

Table 4- 343

Reported Dose Response Functions Relating Sulfate Exposures to Adverse Health Effects

Adverse Health Effect	Threshold Concentration of Suspended Sulfates ($\mu g/m^3$)	Exposure Duration	Relative Increase in Health Effect Per 10 $\mu g/m^3$ Increase Above Threshold	Upper Limit of Prediction
Increased Daily Mortality	25 $\mu g/m^3$	24 hrs. +	2.5%	60 $\mu g/m^3$
Aggravation of Heart and Lung Disease in Elderly	9 $\mu g/m^3$	24 hrs. +	14.0	60 $\mu g/m^3$
Aggravation of Asthma	6-10 $\mu g/m^3$	24 hrs. +	33.0	35 $\mu g/m^3$
Excess Acute Lower Respiratory Disease	13 $\mu g/m^3$	One or more years	77.0	25 $\mu g/m^3$
Excess Risk of Chronic Bronchitis				
Non-Smokers	10 $\mu g/m^3$	Several years	134.0	30 $\mu g/m^3$
Smokers	15 $\mu g/m^3$		74	30 $\mu g/m^3$

Source: United States Environmental Protection Agency, cited by Energy Resources Conservation and Development Commission, State of California; Westman, Quantifying Benefits of Pollution Control.

could constitute a more significant parameter than SO_2, from which such sulfates are formed. The acid sulfate H_2SO_4 is a more potent irritant than SO_2 at the same levels. The threshold of human response to H_2SO_4 has been reported in the range 0.6-0.86 mg/m^3 (600-850 ug/m^3) although particle size distribution, a critical factor in aerosol toxicity was not reported for these tests. (4-63, 64, 65) Response of the central nervous system has been reported at levels as low as 0.4 ug/m^3.

4.795
Inhalation of sufficient concentrations of the H_2SO_4 mist causes irritation of the upper respiratory tract. At exposures greater than 0.35 to 0.5 ug/m^3 under controlled conditions, the responses of human subjects to H_2SO_4, mist include bronchospasm, manifested as wheezing, spasmodic coughing, and difficult, labored breathing, increased upper respiratory tract secretions, and rapid respiratory rate, all indicative of increased airway flow resistance. (4-65) The onset of increased respiratory rate is reported to constitute a reflect action which decreases the retention time, and therefore affects potential of H_2SO_4. (4-63, 64) However, increased airway resistance can severely hinder breathing in persons with cardiorespiratory deficiency, making it more difficult to obtain oxygen. (4-65) Moreover, increased respiratory secretion can impair gas exchange in the lung, eventually resulting in carbon dioxide accumulation and respiratory acidosis. Inhalation of H_2SO_4 concentrations higher than 0.5 ug/m^3 is reported to produce severe bronchospasm or pulmonary edema and over extended periods, bronchieactases or fibrosis of the lung. Following an accidental acute occupational inhalation of the mist of sulfuric acid, victims have exhibited the above symptoms as well as edema of the larynx and upper airway, and emphysema. (4-66) Factors which reportedly potentiate the response to H_2SO_4 mist include high temperature and humidity, (4-67) and particle size (i.e., in the range of 2.5 um). Few data are available concerning the toxicity of other sulfates, particularly the metallic sulfates. Based on the reported results of studies of exposures on laboratory animals, zinc ammonium sulfate and ferric sulfate are considered to have relatively high irritant toxicity, while ferrous sulfate and manganese sulfate are considered to be lesser irritants. (4-62)

4.796
To project the effects of sulfur dioxide and related sulfur compounds on native vegetation and agricultural crops it is first necessary to identify the impact receptors. Through coordination with agricultural officials in Pennsylvania, economic and natural vegetation types were identified along with the number of acres occupied by each. These data are presented in Table 4-344. The

Table 4- 314

Economic and Natural Vegetation of Four Communities Near the Proposed Lakefront Site

I. Agricultural field crops(1)

	Acres*
Corn	4,000
Soybeans	200
Wheat	200
Oats	400
Barley	100
Rye	100
Buckwheat	N/A

II. Specialty crops

A. Grapes - 4,000 acres. Many moderate farms.

B. Fruit Trees(1)

	Acres*
Sour cherry	150
Peach	90
Apple	350
Plum	N/A
Prune	N/A
Pear	N/A

C. Vegetables(2)

	Acres*
Asparagus	700
Cabbage	700
Cauliflower	700
Peas	700
Potatoes	500
Tomatoes	500

D. Nursery crops(2)

Christmas trees

Cut flowers and potted house plants

100 acres of: rose, salvia, coleus, snapdragon begonia, ginko, acalca, gladiolus, lilac, geranium, chrysanthemum

Ornamental trees and shrubs

1,800 acres of woody ornamentals on 3 farms

Table 4-344 (Continued)

III. Pasture grasses[1]

	Acres*
Alfalfa	800
Clover (ladino and red)	500
Timothy	600
Birdsfoot trefoil	N/A
Orchard grass	200
Bromegrass	N/A

IV. Natural vegetation[2]

A. Forests of the uplands and lake plain

Beech[3]
Hemlock[3]
Hickory (shagbark, butternut, pignut & mocker)[3]
Maple (sugar)[3]
Ash (white)
Basswood
Black cherry
Dogwood
Oak (black, white, red, and scarlet)
Pine (Virginia, pitch, shortleaf yellow & white)
Sassafras
Sourgum
Quaking Aspen
Yellow Birch

B. Forests of the moist lowlands

Ash (white)
Maple (red and silver)
Willows
Swamp White Oak

C. Hawthorne thickets

Crab Apple
Quaking Aspen
Fire Cherry
Staghorn Sumac
Silky Dogwood
Hawthorne
Arrowwood

D. Meadows

Foxtail
Oats (wild)
Panicgrass
Goldenrod
Ragweed
Smartweed
Miscellaneous herbs & grasses

Table 4-344 (Continued)

E. Wetlands (bogs, marshes and swamps)

Barnyard grass	Sedges
Bulrushes	Willows
Cattails	Skunk cabbage
Duckweed	Marsh marigold

*Acreages from Mr. William Urash of Penn. Crop Reporting Board. Data includes Springfield Township, Girard, Millcreek, and Conneaut Townships (Pa.). N/A = Not Available.

(1) Listed in approximate order of economic importance to the area.

(2) Listed in alphabetical order. Relative economic importance information is not available.

(3) Predominant species. Others listed are associated species appearing in varying quantities.

relative sensitivity of selected vegetation types to certain atmospheric pollutants is shown in Table 345, while the reported toxic effects of sulfur-dioxide and related compounds is presented in Table 4-345.

4.797
The projected annual mean ambient SO_2 concentrations in the range of 42-58 ug/m^3 are less than those that caused observable damage to agricultural field crops (1,700-3,900 ug/m^3 for one to six hours), or pasture grasses (1,400-2,800 ug/m^3 for one to five hours).

4.798
Both ginko and white pine have been injured at SO_2 levels far below those of other species, but well above the combined baseline and plant related increment. Exposure to 168 ug SO_2/m^3 for four hours has caused acute lesion and needle collapse in mature white pine. It is impossible to accurately assess the potential for any long-term impact because no information is available on SO_2 exposures of greater duration than 30 days. Although the projected ambient SO_2 levels with the proposed plant are not high enough to cause acute injury in crops and native vegetation, there may be a measurable increase in chronic injury over the long-term. Therefore, it is not safe to assume that presently undetected effects will not occur in the future unless additional research is conducted. The removal (washing out) of SO_2 by precipitation can lower the pH of the rainfall reaching an area and thereby affect vegetation growth and soil chemistry. This is not expected to be a significant effect of the proposed plant because the low background pH of rainfall in the area would result in less SO_2 washout than would otherwise occur, and the multiple emission source origins of the plant will lessen the potential for high SO_2 concentration at any single point. Additional information on acid rains is presented in the air quality impact section contained elsewhere in this chapter.

4.799
There seems to be very little, if any, potential for adverse impacts on the Regional Study Area vegetation due to the sulfate (SO_4) contribution of the proposed Lakefront Plant. The ambient sulfate concentrations are projected to remain about 7-15 ug/m^3, while the concentrations reported to cause injury to agricultural and pasture crops have ranged from 100,000 to 158,000 ug/m^3 (refer to Table 4-346).

4.800
Effects on Wildlife and Domestic Livestock. There are insufficient data to determine whether sulfur oxides and suspended sulfates could have deleterious effects on animal life in the general vicinity of the Lakefront Plant.

Table 4- 345

General Relative Sensitivity of Selected Vegetation Types
to Air Contaminants

S=Sensitive
I=Intermediate
R=Resistant

Vegetation	SO_2	NO_2	Ozone	PAN
I. Agricultural Crops				
Corn	R		S	R
Soybean	S			I
Wheat	S		S	I
Oats	S		S	S
Barley	S		S	I
Rye	S			
Buckwheat	S			
II. Specialty Crops				
Grapes	I		S	
Fruit trees:				
Cherry				
Peach				
Apple	S			
Plum				
Pear	S			
Prune				
Vegetables:				
Potato	S		S	
Tomato	S		S	S
Lettuce	S			S
Peas	I			
Cabbage	I			R
Nursery crops:				
Chrysanthemum	R			R
Rose	R			
Azalea		S		R
Gladiolus			R	
Geranium			R	
Lilac			S	
Snapdragon				
Petunias			S	S
Begonia			S	R

Table 4-345 (Continued)

S=Sensitive
I=Intermediate
R=Resistant

Vegetation	SO_2	NO_2	Ozone	PAN
III. Pasture Grasses				
Alfalfa	S		S	I
Clover	S			
Bromegrass				
IV. Natural Vegetation				
Birches (all)	S		R	
American Elm	S			
Lombardy Poplar	S			
White Pine	S	S	S	
Quaking Aspen	S		S	
Sugar Maple	R		R	
Red Maple	I		R	
Basswood	I		R	
Black Willow	S			
Silver & Norway Maple			R	
Dogwood			R	
Sycamore			S	
White Oak	I		S	
Virginia Pine			S	
Hemlock			S	
Pitch Pine			S	
Honey Locust			S	
White Ash	S		S	
Sweetgum			S	
Spruces			R	
Firs			R	
Catalpa Sp.	S			
Larch Sp.	S			

Source: References 4-127 thru 4-131.

Table 4- 346

Reported Phytotoxic Impacts of SO_x on Vegetation Types Found in the Area Surrounding the Proposed Lakefront Plant Site

Agricultural Crops	Plant	Minimum Concentration	Duration of Exposure	Developmental Status	Symptom	Reference
Sulfur Dioxide	Soybean (var. Scott)	2800 $\mu g/m^3$	4 hours	Seedling	10% leaf burn	4-171
	Wheat	2240	1	Seelding	Leaf Burn	4-172
	Barley	1680	8	Seedling	Leaf Burn	4-172
	Barley	2800	3	Seedling	Growth reduction	4-173
	Rye	1680	3	Seedling	Growth reduction	4-172
	Oats	1680	3	Seedling	Growth reduction	4-172
	Buckwheat	3920	6	Seedling	Growth reduction	4-172
Sulfate	Wheat	25 ppm (100,000 $\mu g/m^3$)		Mature	Growth retardation	4-170
	Barley	103 ppm (412,000 $\mu g/m^3$)		Mature	Leaf burn	4-170
	Corn	45 ppm (180,000 $\mu g/m^3$)		Mature	Leaf burn	4-170
						4-170
Specialty Crops						
Sulfur Dioxide	Cabbage, (var. All Seasons)	2800 $\mu g/m^3$	4 hours	Seedling	30% leaf burn	4-171
	Tomato, (var. Roma)	2800	4	Seedling	30% leaf burn	4-171
	Tomato	1400	4	Seedling	Severe leaf burn	4-174
	Rose	2156	6	Mature	Severe leaf burn	4-172
	Salvia	2800	5	Mature	Severe leaf burn	4-172
	Pine, (Eastern White)	168 $\mu g/m^3$	4 hours	Mature	Acute lesion, needle collapse	4-175
	Pine, (Red)	1400	2	Mature	Needle tip burn	4-176
	Grapes	9,432 $\mu g/m^3$	1 hour	Mature	Leaf necrosis	4-177
	Petunia	1400	2	Seedling	Reduced shoot growth and flowers formed	4-178
	Coleus, (var. Scarlet Rainbow)	2800	2	Seedling	Reduced shoot growth and flowers formed	4-178
	Snapdragon	11200	2	Seedling	Reduced shoot growth and flowers formed	4-178
	Begonia, (var. Linda)	11200	2	Seedling	Reduced shoot growth and flowers formed	4-178

Table 4-24f (Continued)

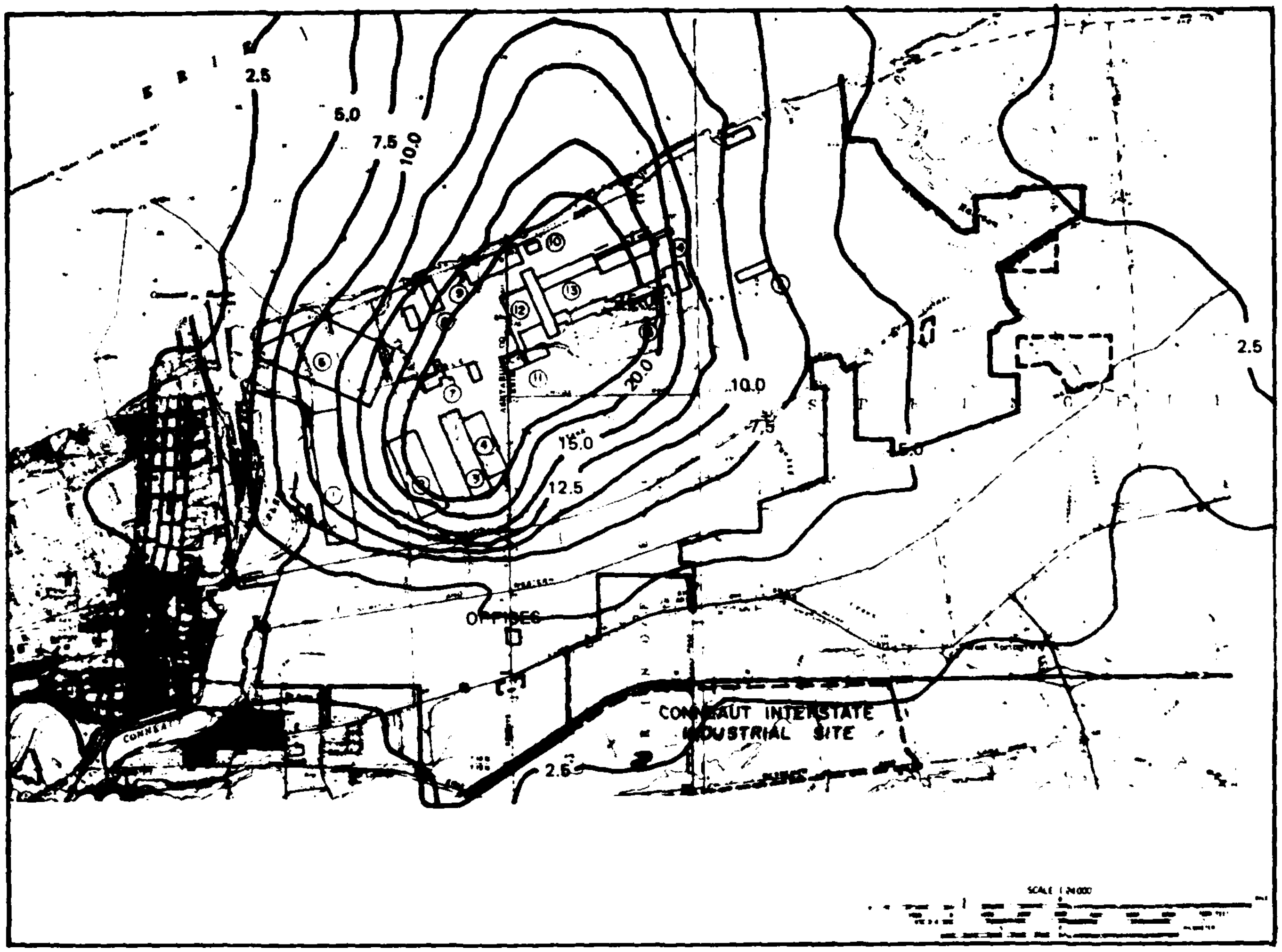
Specialty Crops (Cont.)	Plant	Minimum Concentration	Duration of Exposure	Developmental Status	Symptom	Reference
Sulfur Dioxide (Cont.)	Ginko	140	720	Seedling	Reduced shoot growth and flowers formed	4-17[illegible]
Sulfate	Tomato	63 ppm (252,000 $\mu g/m^3$)		Seedling	Leaf burn	4-17[illegible]
Pasture Grasses						
Sulfur Dioxide	Alfalfa	1400 $\mu g/m^3$	4 hours	Seedling	30% leaf burn	4-171
	Alfalfa	1680	5	Seedling	Leaf burn	4-172
	Clover, (sweet)	1680	4	Seedling	Leaf burn	4-172
	Timothy	2240	1	Seedling	Leaf burn	4-172
	Brome grass, (var. Soc Smoth)	2800	4	Mature	30% leaf burn	4-171
Sulfate	Alfalfa	125 ppm (580,000 $\mu g/m^3$)		Seedling	Leaf burn	4-17[illegible]
Natural Vegetation						
Sulfur Dioxide	Maple, (Norway)	140 $\mu g/m^3$	720 hours	Mature	Severe leaf necrosis	4-17[illegible]
	Oak, (Pin)	140	720	Mature	Severe leaf necrosis	4-17[illegible]
	Pine, (Eastern White)	168	4	Mature	Acute Lesions, needle collapse	4-175
	Pine, (Red)	1400	2	Mature	Needle tip burn	4-17[illegible]
	Bentgrass (var. Penncross)	2380	6	Seedling	Moderate leaf burn	4-174
	Fescue, (var. Pennlawn)	2380	6	Seedling	Moderate leaf burn	4-174
	Bluegrass, (var. Merion)	2380	6	Seedling	Moderate leaf burn	4-174

4.801
Numerous mammalian species have been used to test responses to sulfur oxides, including SO_2 and particulate sulfates. Such species include the guinea pig, rat, rabbit, cat, dog, and swine. Sulfur dioxide is reportedly capable of producing broncho constriction or other irritant effects in all mammalian species tested. Pathological lung change or mortality is reported due to SO_2 exposure, but only at relatively high concentrations.

4.802
Sulfuric acid and some particulate sulfates have demonstrated toxicity greater than that of SO_2 in experiments on laboratory animals. The increasing order of sensitivity was found to be rabbits, rats, mice, and guinea pigs. The latter are considered among the most sensitive and died of exposure not lethal for other species. Concentrations used to determine these sensitivities are in the range of 87-1,600 mg/m^3. (4-62) Animal test systems were also used to observe the relatively high toxicity of zinc ammonium sulfate and ferric sulfate. The paticulate oxidation products of SO_2 reportedly have generally greater irritant potency than the gas. These tests have been conducted to examine the toxic effects of the sulfur oxides and the reaction products so that the effects on human health can be extrapolated. Consequently, studies are not available for other mammalian species in the natural wildlife or domestic category. The determination of thresholds for adverse health effects for other species, some of which show greater or lesser sensitivity than humans in lab tests, is therefore based on quantitative evidence not directly comparable to exposures under ambient conditions. Moreover, data are not available with respect to these parameters for certain species, e.g., cattle, which are of economic importance to the area. Therefore, it is not feasible to attempt to correlate the predictions of ambient levels with potential impacts to wildlife or domestic animals.

Particulates

4.803
The determination of threshold particulate concentrations is difficult considering the number of variables which effect overall toxicity. Establishment of threshold limits further complicated by changes in toxicity as particulates interact with other substances in the atmosphere (synergism). Isopleths of projected particulate increments (refer to Figure 4-106) show that populated areas to the west of the site would experience an annual average increase in particulate concentration ranging from 2.5 to 5.0 ug/m^3. The applicant's sampling program indicated that the long-term primary



Source: MCDM Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates.

FIGURE 4–106 PROJECTED ANNUAL AVERAGE INCREMENT IN AMBIENT TOTAL SUSPENDED PARTICULATE CONCENTRATIONS FROM THE PROPOSED LAKEFRONT PLANT ($\mu g/m^3$)

standard for particulates of 75 ug/m^3*, was attained on the site in 1977. However, projected air quality data indicate that outside the plant, boundary would remain within the primary standard for particulates, including the increment attributable to the Lakefront facility. Accordingly, the projected annual increase in total suspended particulate concentration would not represent a potential health hazard (refer to Table 4-342).

Effects on Vegetation

4.804
The annual geometric mean level of particultes (baseline and plant increment) is projected to range from 65-79 ug/m^3 on the site to 46-60 ug/m^3 just beyond the site boundary (refer to Table 4-341). Data obtained from the applicant's air quality monitoring effort indicate that a large proporton of the site will experience incremental values greater then 10 ug/m^3. However, much of this area will have already been cleared of vegetation during the construction phase. The uncleared portions of the site primarily to the east of the facility will receive annual mean particulates increases in the range of 2.5-10 ug/m^3. In 1977, high particulate values were measured on the site but no apparent vegetation damage was noted during the surveys conducted by Aquatic Ecology Associates (AEA). Vegetation damage may occur on a localized basis along plant access roads where dust and vehicle emissions are the principle source of particualte loading. Overall impacts associated with particulate fallout will be limited geographically and should not affect agricultural crops or native vegetation in the areas sourrounding the Lakefront Plant site.

4.805
Effect on Wildlife. At the present time there are little data regarding the effect particulate emissions have on terrestrial fauna or domestic farmstock. Most studies assess not the overall particulate but rather the individual trace elements contained in particulate matter.

Hydrocarbons and Related Compounds

Effects on Human Health

4.806
The applicant's onsite montoring data indicate that B(a)P concentrations average about 0.00039 ug/m^3. Although the incremental increase in B(a)P concentration has not been quantified for the Lakefront facility, it is expected to be low since coke oven control equipment will greatly minimize emissions. The majority of the

* Annual Geometric Mean

polyeyelic aromatic hydrocarbons including B(a)P are generated during the manufacture of coke. Insufficient data exist to determine the impact of operations on the health of individuals living in the general vicinity of the Lakefront site. The concentrations of B(a)P measured on the proposed plant site are nearly an order of magnitude lower than the Soviet MAC vakye (analogous to the threshold limit concept) and are well below the concentrations observed in the more heavily contaminated U.S. urban areas. However, baseline ambient levels exceed the level which Yanysheva (4-68) has suggested may be associated with a specific incidence of malignant tumors. Both Ashtabula County, Ohio, (to a very small extent, i.e., 31.6 versus 29.9) and Erie County, Pennsylvania (41.1 versus 31.5) presently exceed the mean rate of male lung cancer mortality for all counties (combined) in the respective states. In the United States, no thresholds of response or realistic dose response functions have been formulated for human exposures to chemical carcinogens such as B(a)P. There is disagreement over the existence of a level below which these types of substances exert no effect. Due to the possibility of 1) interaction with other substances, 2) the additive and irreversible nature of carcinogen exposure, and 3) the long latent period (25 years or longer in some cases) required for tumor growth, some researchers adopt the conservative position that any level of exposure increases the risk of cancer. Alternative positions consider the concepts of maximum allowable (MAC) or minimum unavoidable concentrations, above which the risk is greatly increased. No MAC value or its equivalent threshold limit value has been adopted in the United Sates. In the USSR a maximum allowable concentration of 0.1 ug/100m^3 (0.001 ug/m^3) was adopted, although an unverified study by Yanysheva (4-68) suggested a lower B(a)P concentration might be responsible for malignant tumors. However, the International Agency for Research on Cancer has adopted the position that no prediction of human cancer risk can be made from simple knowledge of PAH existing in the environment, given inadequate epidemiological data and the possibility of synergism (or antagonism) with other substances. (4-69)

4.807

<u>Other Hydrocarbons</u>. Other hydrocarbons, specifically the nonmethane hydrocarbons (NMHC), represent an indirect contribution to potential impacts on human populations, through their role in the formation of photochemical oxidants. These are mostly due to vehicle traffic, but are also emitted to a degree by plant operations. Offsets in NMHC emissions will be required by EPA for attainment of ozone air quality standards, resulting in a projected regional reduction in such emissions.

4.808
Ozone. As in much of the eastern United States, ambient ozone levels regularly exceed the primary standard in the Regional Study Area and the Air Quality Control Region is classified "nonattainment" for this parameter. Although the offset policy as applied to the plant may reduce local ozone concentrations under episodic conditions, the potential for adverse health effects among the hypersensitive would continue to be expected if typical conditions continue to approach the range of 0.1 ppm. This would be true under projected baseline or plant related impact conditions. Ozone is a respiratory irritant, and is the most toxic of the investigated photochemical oxidants. Irritant effects are observed in sensitive individuals at about the level of odor detection (0.05 ppm), and levels on the order of 0.1 ppm are associated with difficult breathing in patients with emphysema. (4-70) In general, those with impaired lung function constitute a group particularly susceptible to ozone exposure, and acute effects may be observed from short-term exposures in the range 0.1-1.0 ppm.

Effects on Vegetation and Wildlife

4.809
Ethylene. Data are not available on the concentration of ethylene that could be produced by steel plant emissions, or on the present levels of ambient ethylene on the site. Therefore, it is not possible to assess the potential impact of ethylene emissions on wildlife or vegetation.

4.810
Ozone. Since the proposed site is in a nonattainment zone for oxidants, net reductions in emissions of nonmethane hydrocarbons would be required of new sources as part of the effort to meet National Ambient Air Quality Standards. Therefore, operation of the plant would be expected to locally increase reactive hydrocarbon levels by a small amount and lead to a reduction in the contributing NMHC levels throughout the overall bi-State area. No information are available on the annual mean ozone concentrations in the Region. The ozone concentrations that have produced injury symptoms in the types of vegetation found on the proposed site are listed on Table 4-347. Mature grapes are the most sensitive of the investigated species to ozone, showing stipple after exposure to 0.5 ppm for three hours. White pine is the next most sensitive, for it exhibited needle tip necrosis after one-hour at five ppm ozone. These data indicate that most of the area agricultural field crops are sensitive to ozone. Grapes are the most important fruit crop in both Erie and Ashtabula Counties, so, while nonattainment status continues, there is potential for economic impacts related to ozone injury. By causing an

Table 4-347

Toxic Impacts of Ozone on the Types of Vegetation Found in the Area of the Proposed Lakefront Plant

Agricultural Crops	Plant	Minimum Concentration	Duration of Exposure	Developmental Status	Symptom	Reference
Ozone	Corn (var. Portowalco)	25 ppm	2 hours	Seedling	Leaf bleaching	4-145
	Soybean (var. Hawk, Dars, Kent, Lee, Clark, Scott, Amsay)	30	1.5	Seedling	Leaf chlorotic fleck and lesions	4-132
	Wheat (var. Wakeland, Hadden, Ga. 1123)	34	2	Seedling	Chlorotic stipple on blade to necrotic lesions	4-146
	Oats (var. Overland)	23	2	Seedling	Chlorotic stipple on blade to necrotic lesions	4-145
	Oats (var. Clintland)	50	1	Seedling	Chlorotic stipple on blade to necrotic lesions	
	Barley (var. Ga. Jet, Davie, Dayton)	34	2	Seedling	Leaf tip burn	4-147
	Rye (var. Gator, Weser, Florida Black)	34	2	Seedling	Leaf tip burn	4-146
Specialty Crop						
Ozone	Apple, (var. Cortland McIntosh, Rome)	1800 ppm	72 hours	Reproductive	Brown pitted areas around leaf lenticals	4-148
	Potato, (var. Kennebuc, Nordland & Sebago)	100	4	Mature	Leaf necrosis; reduced yield	4-149
	Tomato, (24 cultivars)	25	1.5	Seedling	Leaf tip burn and necrosis	4-150
	Tomato, (var. Bonny Best)	10	8	Seedling	Leaf tip burn and necrosis	4-151
	Tomato, (var. Roma)	10	4	Seedling	Leaf tip burn and necrosis	4-132

Table 4-347 (Continued)

Specialty Crop (Continued)	Plant	Minimum Concentration	Duration of Exposure	Developmental Status	Symptom	Reference
Ozone (Continued)	Begonia	41 ppm	2 hours	Seedling	Leaf chlorotic fleck and lesions	4-145
	Geranium	41	2	Seedling	Leaf chlorotic fleck and lesions	4-145
	Petunia, (var. Rose Charm)	34	2	Seedling	Leaf Chlorotic fleck and lesions	4-145
	Coleus, (var. Benth)	10	8	Seedling	Leaf stipple and necrosis	4-151
	Chrysanthemum	30-100	8	Seedling	Leaf stipple and necrosis	4-151
	Pine, (Virginia)	10	8	Seedling	Needle tip necrosis	4-152
	Pine, (Eastern White)	5	1	Seedling	Needle tip necrosis	4-137
	Grape	0.5 ppm	3	Mature	Stipple on leaves	4-153
Pasture Grasses						
Ozone	Alfalfa, (var. Dupuits, Atlantic)	20	4	Seedling	Leaf tip burn and necrosis	4-154
	Alfalfa, (var. Ranger)	20	2	Seedling	Leaf tip burn and necrosis	4-145
	Clover, (red. var. Kenland, Penscott Chesapeake)	15-20	4	Seedling	Leaf tip burn and necrosis	4-154
	Clover, (species Ladino Alskie, Sweet [white])	20	4	Seedling	Leaf tip burn and necrosis	4-154
	Orchard Grass	35	2	Seedling	Leaf tip burn and necrosis	4-145

Table 4- 347 (Continued)

Natural Vegetation	Plant	Minimum Concentration	Duration of Exposure	Developmental Status	Symptom	Reference
Ozone	Pine, (Virginia)	10 ppm	8 hours	Seedling	Needle tip necrosis	4-152
	Pine, (Eastern White)	5	1	Seedling	Needle tip necrosis	4-152
	Ash, (Green)	25	4 hours/day/ 2 weeks	Mature	Leaf surface bronzing	4-155
	Fescus, (var. Pennlawn)	30.	6	Seedling	Dark brown blade necrosis	4-135
	Bluegrass, (var. Delta)	30	6	Seedling	White necrosis	4-135
	Bentgrass, (var. Penncross	23	6	Seedling	Necrosis and bleaching	4-135
	Bentgrass, (var. Annual	30	6	Seedling	Necrosis and bleaching	4-135
	Ryegrass, (var. Lamer Manhattan	30	6	Seedling	Necrosis and tleaching	4-135

application of the emissions offset policy, a net decrease in regional hydrocarbon emissions is expected to result from operation of the plant. The incremental addition of ozone as a result of Lakefront Plant operations will not be high. However, the total, when added to ambient levels, may be enough to increase chronic injury in such crops as grapes, corn, wheat, oats, barley, potato, and tomatoes. Nursery crops are also sensitive to ozone. Further, the synergistic interactions of ozone with such constituents as sulfurdioxide and nitrous oxide can cause acute and chronic injury at lower concentrations than those observed individually. Information on ozone damage and its synergistic interaction with other atmospheric pollutants is limited. Therefore, the applicant has been instructed to initiate studies over the short and long-term which will determine the effect that Lakefront Plant emissions will have on local and regional agricultural resources.

4.811
PAN (Peroxyacetylnitrate). Data and projections are not available on the baseline or plant impact concentrations of PAN, so it is not possible to assess the envrionmental impacts associated with PAN emissions. Since regional decreases, and small, long-term local increases in hydrocarbon emissions are expected after the plant is in operation, it is expected that no significant increases in PAN concentrations will be experienced.

4.812
Effects on Vegetation and Wildlife. The present background annual mean ambient NO_2 concentration in the area of the proposed plant is 46-52 ug/m^3. This is much lower than the lowest concentration causing observable injury symptoms (284.8 ug/m^3) to alfalfa (refer to Table 4-348). The projected NO_x increment due to the proposed plant raises the ambient estimate to 28 ug/m^3, but would be well below this effects threshold. The possibility of a synergistic reaction between SO_2 and NO_2 could affect all vegetation. For example, the interaction between SO_2 and NO_2 has caused injury to eastern white pine, beans, and tobacco at levels where neither pollutant alone caused damage. (4-71) Levels of both of these contaminants are projected to be quite low during plant operations, however, the potential for synergistic interaction does exist. Based on laboratory study results, the projected concentrations of NO_x would not be expected to constitute a direct hazard to the health of mammals in the vicinity of the site. Studies of the effects of NO_2 on laboratory animals have reported biological and biochemical effects of acute and chronic exposure. Changes in lung tissue reportedly elicited by NO_2 exposure are not specific for this oxidant, but resemble the effects of ozone and other irritants. Continuous exposure over 3-12-month periods to relatively high levels of NO_2

Table 4- 3^3

Phvtotoxic Effects of NO_2 on the Types of Vegetation Found in the Area of the Proposed Lakefront Plant

Agricultural Crops	Plant	Minimum Concentration	Duration of Exposure	Developmental Status	Symptom	Reference
Nitrogen Dioxide	Oats (var. Park)	0.60 ppm	0.08 days (2 hours)	Seedling	Inhibition of photosynthesis	4-145
	Oats	6 ppm	3	Mature	Bleached internal lesions	4-156
Specialty Crops						
	Tomato, (var. Pearson Improved)	0.3-0.5 ppm	10.0 days	Seedling	Growth retardation; leaf distortion	4-157
	Tomato, (var. Pearson Improved)	0.40 (752 μg/m3)	45.0	Mature	Decreased yield	4-158
	Azalea	0.50	0.08	Mature	40% leaf necrosis	4-159
	Pine, Eastern White	0.58	0.04	Mature	Needle tip burn	4-160
	Pinto Bean	1 ppm	4	Mature	80% injury (necrotic stippling)	4-161
Pasture Grasses						
	Alfalfa, (var. Ranger)	0.60 ppm	0.08 days	Seedling	Inhibition of photosynthesis	4-145
	Alfalfa	0.16 (284.8 μg/m3)	6 hours/day for 4 days	Mature	Necrosis of leaves	4-132
	Alfalfa (Ranger)	6 ppm	3	Mature	Intercostal bleaching	4-156

(10-25 ppm) has reportedly induced emphysema-like disease in rats, mice, rabbits, and dogs. In the rat, the disease is characterized by enlargement of the lung and reduction in the number of air spaces. Other such effects of NO_2 exposure include alteration of the molecular structure of lung collagen, and alteration of blood or tissue enzymes.

Potential Effects of Short-Term "Worst Case" Emissions

4.813
The methodology used to project "worst case" air quality situations for each parameter is discussed in detail in the Air Quality Impacts section of this chapter. For reasons cited in that section, the projected concentrations are considered conservative, and may actually be lower, or may be observed with less than the projected frequency.

SO_2 and Related Parameters

Effect on Human Health

4.814
Sulfur Dioxide (SO_2). Assuming background maxima during operational phases do not exceed the levels discussed below, concentrations of SO_2, including plant increments, would be below the reported thresholds of human acute response. Acute effects of ambient SO_2 exposure were reportedly associated with 24-hour concentrations in excess of 200 ug/m^3 (refer to Table 4-342). The primary standard for 24-hour maximum SO_2 exposure is 365 ug/m^3, not to be exceeded more than once per year. Increased mortality has been reported from daily concentrations in excess of the standard. Worst case estimates of 24-hour SO_2 increases attributable to the plant, are in the range of 80 ug/m^3. Maximum 24-hour ambient concentrations recorded in the vicinity of the site were in the range of 80-100 ug/m^3 (refer to Table 4-341). However, synergism between SO_2 and particulates could constitute a potential irritant problem among the hypersensitive (e.g., those predisposed to respiratory problems).

4.815
Sulfate (SO_4). The 24-hour maximum sulfate concentrations are projected to include an increment attributable to the plant in the range 1-7 ug/m^3, under "worse case" conditions. These and all other projected sulfate levels in this report are considered far less certain than projections for other parameters. The worst case conditions for sulfate concentrations are projected to occur no more than once in three years. No reliable threshold sulfate concentrations associated with mortality among humans have been established, the worst case

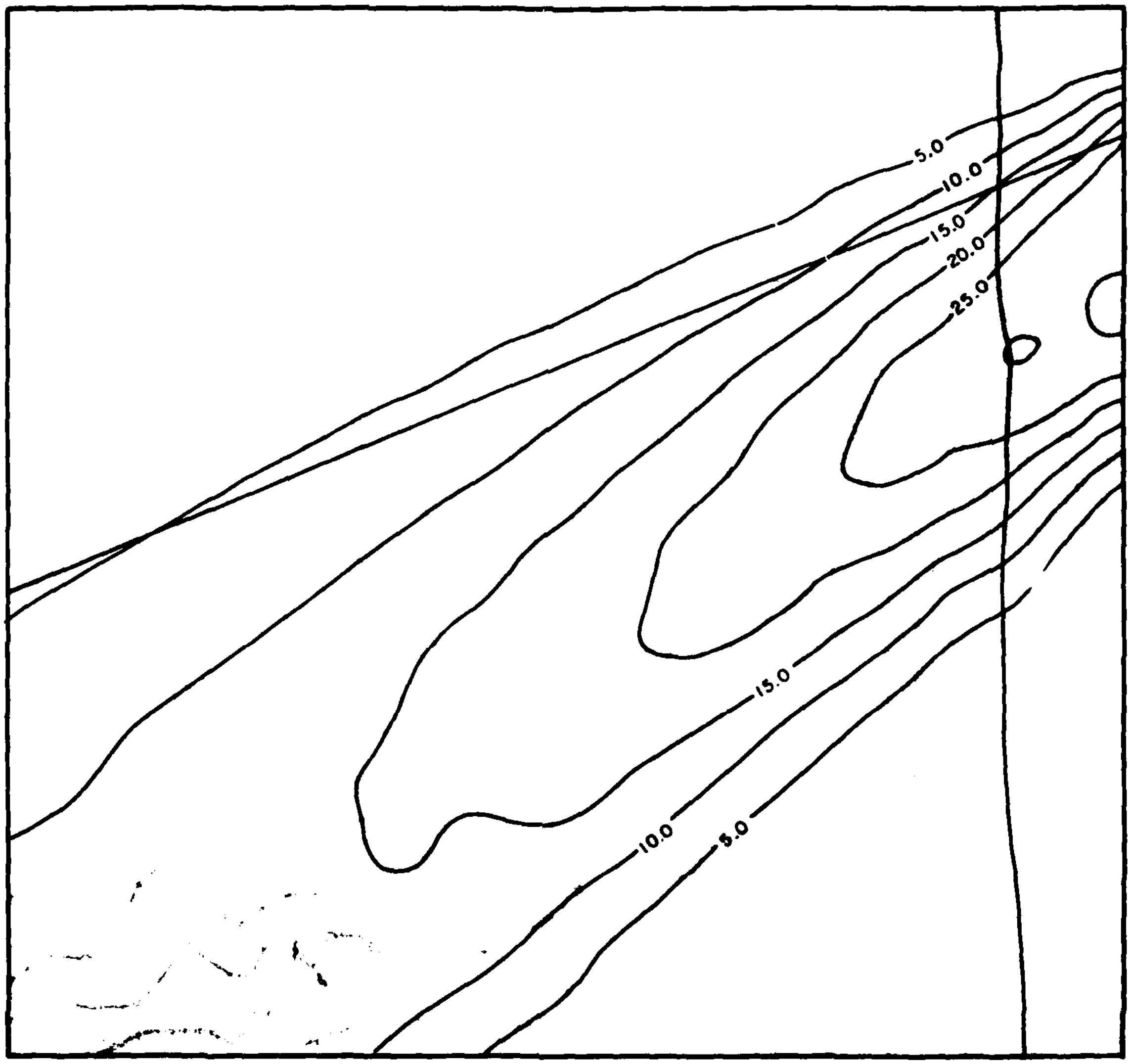
values (1-7 ug/m^3) plus existing high background (about 20 ug/m^3) would correspond to EPA threshold estimates for health effects (about 25 ug/m^3, see Table 4-345). Since sulfate formation is a relatively long-range transport phenomenon, residents within an area less than 100 square kilometers (20-50 kilometers downwind) constitute the potential exposure group.

Effects on Vegetation

4.816
Projected worst case increases in air emissions due to plant operation are shown in Table 4-341. The present baseline concentration of 80-100 ug/m^3 of SO_2 as a 24-hour maximum is below the levels at which injury to vegetation is expected (no vegetation injury due to pollution has been recorded on the site). The "worst case" plant increment of 80 ug/m^3 could have an impact on the more sensitive species remaining on the site since it would raise the projected ambient concentration to 160-180 ug/m^3. Mature white pine has been reported to experience acute lesions and needle collapse at 168 ug/m^3, while 140 ug/m^3 has been reported to produce reduced growth in ginko seedlings. Neither species is prevalent on the proposed site, although some plantations of white pine occur along Lake Road and near Elmwood Road.

4.817
Norway maple and pine oak both can show severe leaf necrosis at 140 ug SO_2/m^3, so it is possible that the "worse case" 80 ug/m^3 increment caused by the plant, added to the projected background of 80-100 ug/m^3, would be great enough to cause visible injury to appear on these species. The area where the "worst case" SO_2 increment is projected to be greatest on and adjacent to the site is shown in Figure 4-107. The vegetation in the increment area southwest of the plant site, in Ashtabula County includes deciduous forests, where Norway maple or analogous species would be growing. Should the growth of these species be inhibited by SO_2, the successional patterns of the community could be changed. The worst case increment for rainfall sulfate (0.3 mg/1) could cause a rainfall pH drop of approximately 0.03, which is expected to be too small to affect the growth of specialty crops sensitive to pH.

4.818
The major field and fruit crops grown in the County are clover, oats, grapes and apples, and all, except grapes, are sensitive to concentrations in excess of 1,000 ug/m^3 of SO_2, (refer to Table 4-346). Thus projected "worst case" SO_2 levels in the impact area are not expected to affect crop yields.



Source: RAM Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates.

FIGURE 4–107 WORST EXPECTED 24-HR AVERAGE SO_2 INCREMENT DUE TO THE PROPOSED LAKEFRONT PLANT ($\mu g/m^3$)

Particulates

4.819
Effects on Human Health. The estimated 24-hour maximum particulate concentration increment attributable to the proposed plant is 30 ug/m^3. Including projected background, the "worst case" total 24-hour maximum concentration-in-years is projected to be about 145 ug/m^3 (refer to Table 4-341). These levels are well below the primary standard of 260 ug/m^3. There is no conclusive evidence that daily maxima of TSP below the standard represent a potential health hazard. During 1977, one of the sampling monitors recorded short-term particulate concentrations in excess of the primary standard, while at two other monitoring locations, the level of the primary standard was approached. These background levels are projected to decline under existing control plans.

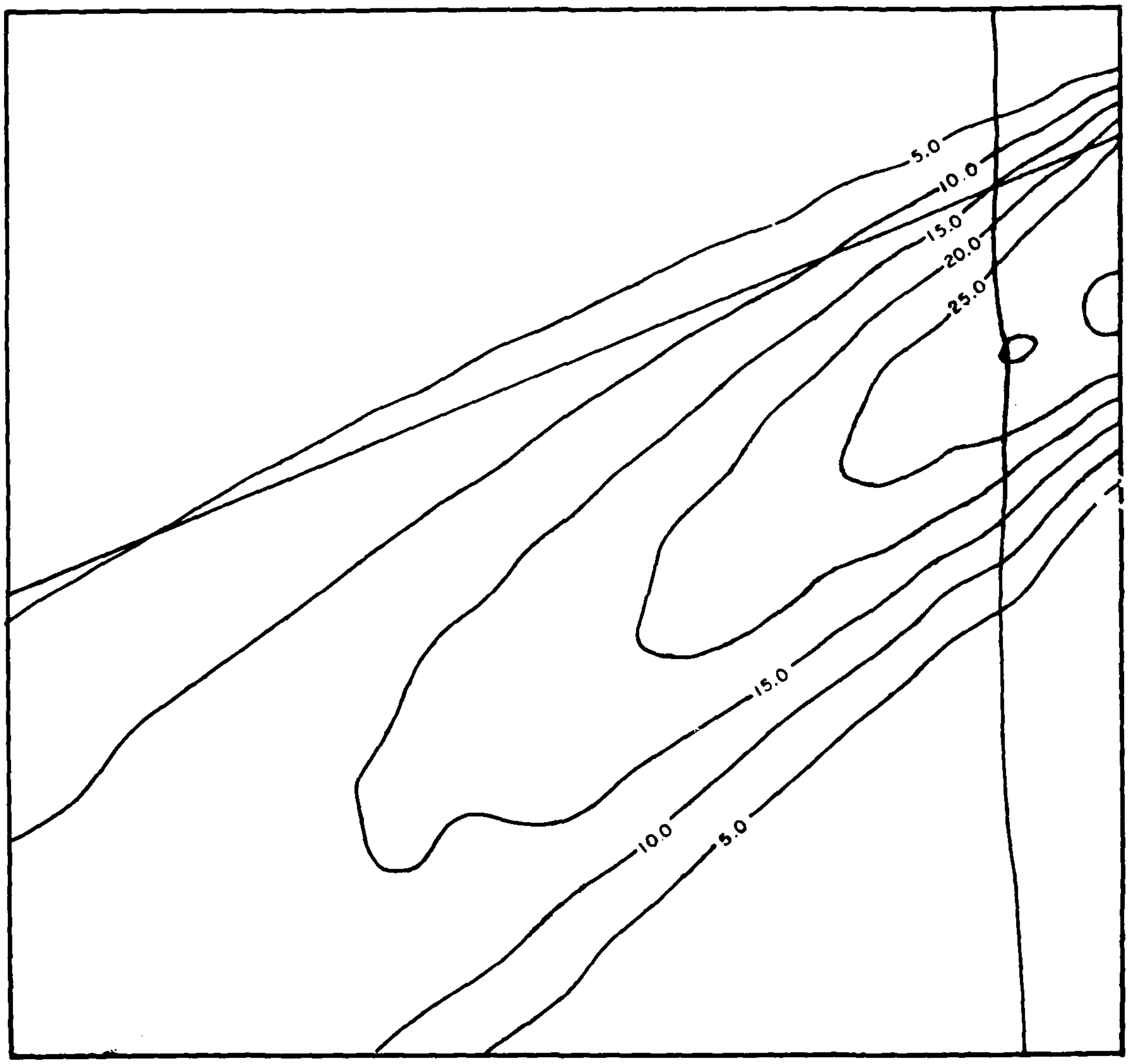
4.820
Effects on Vegetation and Wildlife. The worst case, a 24-hour maximum ambient (off-site) concentration of particulates predicted to occur two to three times per year when the proposed plant is in operation is about 145 ug/m^3. This would represent an increase of 10 ug/m^3 above the present background level (refer to Table 4-341). The area affected by this worst case increment are shown in Figure 4-108. Particulate increases of up to 15 ug/m^3 are projected in Ashtabula County, where grapes and apples are the two predominant fruit crops. Since the effects of the background particulate maxima on vegetation have not been assessed, it is not possible to predict the impact the plant related increment combined with the baseline concentration will have on area vegetation. Exposure to the projected "worst case" particulate may affect wildlife and livestock. However, little research has been performed to determine the physiological response or health related impacts on these individuals.

Hydrocarbons and Related Parameters

Effects on Vegetation and Wildlife

4.821
Ethylene. It is not possible to assess the potential for ethylene impacts since no information is available on the expected ambient or plant concentrations of this substance. However, total NMHC concentrations are assumed to decrease in the bi-State area due to the application of emissions offset considerations to the plant and related growth.

4.822
Ozone. The expected ozone concentration of 0.185 ppm (one hour maximum) is below those that have produced injury symptoms in plants



Source: RAM Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates.

FIGURE 4–108 WORST EXPECTED 24-HR AVERAGE TOTAL SUSPENDED PARTICULATE INCREMENT DUE TO THE PROPOSED LAKEFRONT PLANT ($\mu g/m^3$)

(0.5 ppm injured grapes), so minimal impacts to vegetation from ozone alone would be anticipated. There is increasing evidence that ozone and SO_2 could act synergistically to produce increased oxidant stipple, (4-72) but lack of quantitative data makes it difficult to assess the potential of such an occurrence.

4.823
PAN. There are no data on the present or projected worst case concentrations of PAN. However, since this substance is a product of reactions with nitrogen oxides, the 26 percent increase in NO_x emissions expected in "maximum plant-related impact" years (1985 and 1990) might cause increases in PAN levels. The potential for PAN injury to vegetation or wildlife cannot be assessed because of the lack of quantitative data on increment levels.

Oxides of Nitrogen (NO_x)

4.824
High NO_2 concentrations can produce injury symptoms similar to those of SO_2, such as chlorosis, necrosis, or growth retardation. The baseline worst case NO_2 concentration of 140 ug/m^3 in 24 hours (refer to Table 4-318) is well below the levels that have caused injury to the types of plants found in the area (refer to Table 4-348). If the projected 26 percent increase in NO_2 occurs in the year of maximum impact then the total ambient level might be 176.4 ug/m^3 in the worst 24 hours. This is still below the 283.8 ug/m^3 that is reported to produce leaf necrosis in alfalfa, one of the most sensitive plants (Table 4-348). Thus, the expected NO_2 increases probably have a very low potential for direct impacts on the vegetation of the site and Regional Study Area. Few data are available concerning the effects on animals of NO_2 exposure at levels below one ppm (2,000 ug/m^3). NO_x concentrations, including NO_2 are projected not to exceed 176.4 ug/m^3 (0.03 ppm).

Primary Impacts of Facility Operations on Terrestrial Biota

4.825
The proposed site will be located on a plateau bounded by Lake Erie to the north and Turkey Creek to the south. Ground deposits are underlain by deposits of clay and glacial till. These materials are highly impervious and restrict surface water infiltration. Wetlands and bodies of water occurring in such areas are commonly referred to as "perched" (not being hydrologically connected to ground water deposits). Runoff which would replenish wetlands and tributaries of Turkey Creek will now be contained within the site and be treated before discharge to Lake Erie. Surface water runoff from undeveloped plant areas in Turkey Creek drainage will flow undisturbed to the creek. Since surface and subsurface moisture over the site is determined mainly by precipitation and not groundwater supplies,

areas lying at elevations below the site will be dryer. The dryer conditions will cause changes on flora communities and associated wildlife. Reduction in moisture would tend to accelerate plant succession in the area between the site and Turkey Creek. This change could lower the value of this area to woodcock and other fauna requiring wetter conditions and benefit species requiring dryer conditions. Community structure would be altered.

4.826
Increased mortality of migrating birds will be experienced due to tall structures such as exhaust stacks and cooling towers. This loss could be significant during periods of limited visibility due to the significant number of these structures and the site's geographic location. As previously mentioned, migrating birds have established flight lanes passing near or over the site. This is believed to be due to the shorter distance across open-water to the Long Point area on the Canadian side of Lake Erie. Possible mitigative measures include the use of strobe lighting to act as a visual repellant.

4.827
Any body of open-water can be an attractive to migrant waterfowl. Large bodies of standing water are especially valuable during winter periods when ice covers prevail. Ash-settling ponds are examples of such bodies of water. Particulates and chemicals dissolved in the water are exposed to waterfowl. An additional hazard is present if transmission towers and lines are located close to, or cross the ponds. (4-168) Slag pits can support lush aquatic vegetation attracting waterfowl. In turn, waterfowl add nitrogen and phosphorus which further promotes aquatic growth. Dabbling ducks and, to a lesser degree, diving ducks are known to ingest slag in such situations. (4-169) The slag may contain high concentrations of calcium, iron, potassium, lead, chromium, and other metals. Toxic metals could have a potentially adverse effect on waterfowl and other organisms in the food chain.

4.828
Approximately 2,770 acres of the steel plant site will be surrounded by fence. Within this area, approximately 1,000 acres will remain in a natural and/or seminatural state. This large area is capable of supporting deer. Since public access will not be allowed, hunting or other means to harvest and control this resource will not be provided. Deer have a high biotic potential and under favorable conditions can overpopulate an area in a relatively short period of time (5-10 years). Overbrowsing will damage and reduce the value of the "greenbelt" areas as buffers. Once the carrying capacity of the area is exceeded, habitat destruction, starvation, and disease will occur.

4.829
The U. S. Steel Plant site contains within its boundaries the Turkey Creek ecosystem and a section of a larger upland ecosystem. Terrestrial communities outside the primary impact area and within the "greenbelt" area will for the most part remain intact. Only limited changes in populations at various trophic levels will occur. Populations of primary consumers such as the eastern cottontail rabbit will be controlled by predators such as red and gray fox and raptors. Historically, deer have been controlled by man. Natural predators of deer have not existed in the area for over 100 years, so natural population control of this species will not occur. Deer are animals of low mobility and emigration does not usually occur. Public access will not be allowed by the applicant. Anticipated deer population increases will cause property damage in the form of vegetative depredation and vehicle collisions. Habitat damage similar to that described earlier could damage mitigation management practices.

4.830
Some of the chemicals expected in surface runoff from the facility (e.g., heavy metals) could have an effect on plant growth immediately adjacent to developed parts of the plant. The maintenance of road and railroad right-of-ways can impact vegetation, particularly if certain herbicides are sprayed over right-of-way areas. If salt is used on roads in the winter, some roadside vegetation would be expected to be affected by the runoff. High noise levels during operation could disturb wildlife in nearby areas, although the wildlife presently found on the site seems generally acclimated to periodic large increases in noise from passing trains and ongoing construction and operations in raw-materials storage areas.

4.831
Onsite Spill Prevention Plan Requirements are part of the plant design, however, in the event of a leak or spill of chemicals in transit (i.e., offsite) wildlife and/or vegetation could be affected. Spills of coal chemicals, such as light oils, could occur near a waterbody affecting both the aquatic and terrestrial biota. Vegetation would be affected by any major changes in soil pH as could occur due to spillage of acids of bases.

4.832
Up to 200 acres of the site may be used for solid waste disposal during the plant's operation. The degree of impact that this use would have on the vegetation and wildlife depends on whether the use is necessary, and where the solid waste disposal would be located. It could have considerable impact on aquatic and terrestrial creek biota.

Secondary Impacts

4.833
The secondary development levels that are projected in association with the Lakefront Plant would cause additional removal of vegetation and wildlife habitat in the area. The degree of impact would be highly site specific, and dependent on the degree to which the types of valued living resources are afforded protection by existing or future land use regulations. The small magnitude of the projected land requirements and availability of sufficient "noncritical" habitat in the various study areas are such that ecologically problematic encroachment could be avoided if available controls are exercised.

Impacts on Aquatic Biota

Primary Impacts

Construction Impacts

4.834
Construction of the proposed steel facility is to be accomplished in two stages. Major activities that would affect the aquatic biota during the first stage include site preparation, intake/outfall construction, pier extension, construction of access roads on the property, and culverting of Turkey Creek. The second stage, which would be ongoing with initial plant operation and would include pier construction and dredging activities as well as continued construction on the cleared site.

4.835
Turkey Creek, Conneaut Creek, Conneaut Harbor, and Lake Erie biota would be impacted to varying degrees, by these activities. The Turkey Creek culverting, harbor pier construction, and dredging activities would have the greatest construction impact potential.

Effects of Construction Activities

Clearing/Grubbing/Grading/Temporary Storage Piles and Routine Procedures

[illegible]
[illegible] impact of clearing, grubbing, and grading activities on [illegible] due to increased suspended materials and siltation. [illegible] are disturbed and exposed during construction are [illegible] surface runoff and erosion. The [illegible] rainfall runoff and deposited in [illegible] turbidity, sedimentation,

suspended and total solids levels. Some of this runoff material could enter Turkey Creek at points above and below the culvert. Some would also enter a number of small unnamed tributaries to Lake Erie, mostly east of Turkey Creek. The major portion of construction runoff will be discharged to Lake Erie after treatment.

4.837
Rainfall on stockpiled soils will also result in runoff containing high levels of solids. The removal of topsoil as a separate layer is planned. It is proposed that this material will be stored in temporary storage piles throughout the site. Similarily, construction materials would be stored in temporary piles throughout the site. These temporary storage piles, especially those of topsoil and other loose material, would be particularly susceptible to erosion. Runoff from these areas will eventually reach the nearsite waterways. The increase in siltation and sedimentation could have the following effects:

- The mechanical or abrasive action of suspended materials can scour streams of benthos and periphytic algae.
- Large amounts of nonnutritive suspended material may affect feeding efficiency of filter feeders in benthic, planktonic, and nektonic portions of the aquatic community by completely or partially filling gut cavities.
- Decreased feeding efficiency of fish dependent on sight.
- Clogging of fish gills and increases in mucous secretions with tissue irritation in extreme cases resulting in mortalities due to anoxia. Some species are more susceptible than others and juveniles of all species are especially sensitive relative to adults.
- Increased turbidity will reduce light penetration consequently decreasing productivity of photosynthetic organisms.
- Increased sedimentation can blanket benthos populations. It can also fill gravel and rock interstices in riffles, thus reducing or eliminating benthos and fish spawning areas. (4-73, 74, 75)
- Runoff percolating through exposed soils which are acidic or alkaline can affect the pH of receiving waterways unless treated prior to reaching streams. Changes in pH can affect species diversity and composition.

In addition to sedimentation and siltation, certain construction activities such as clearing and grubbing may affect stream water temperatures.

4.838
Clearing riparian habitat as originally proposed by the applicant has been shown to affect increases in stream temperatures and considerably higher temperatures were therefore expected in the drainage ditch than presently characterize Turkey Creek. Increases in water temperature and more erratic stream flow could have resulted in lower species diversity. Conversely, the current culvert proposal and greenbelt area around the upper reaches of the creek will maintain ambient temperatures upstream and could result in temperature decreases in the lower reaches due to additional shading by the culvert. However, removal of vegetation during actual culvert installation could lead to increased water temperatures. Proper sedimentation and erosion control plans can minimize the construction related impacts on aquatic ecosystems. Diverting runoff into sedimentation ponds before it reaches the lake and streams and treating this runoff to an acceptable pH range and suspended solids level can significantly reduce the impact. The applicant intends to formulate an erosion control plan conforming to the requirements of the Commonwealth of Pennsylvania (Ohio has no such requirements). The plan will be developed for the entire plant site prior to commencement of construction. To date, plans are developed only to install one or more sedimentation basins where sediment-laden surface runoff can be detained and clarified prior to discharge. The applicant has not provided the location of such basins or the method of treatment. The majority of treated runoff would be discharged to Lake Erie while a small portion would be discharged to Conneaut Creek.

4.839
Chemical wastes that may affect the aquatic biota of natural waters on the plant site and Lake Erie include nutrients, oil, grease, paints, cement, and solvent wastes. Fertilizers that are used during construction to help revegetate disturbed areas can be carried to the lake and streams by runoff. This would increase nutrient loading in the waterways affecting primary productivity. Corps staff believes that the applicant should consult with the USEPA, the Department of Agriculture, and State agencies to determine the proper application rate for fertilizer. Oil, grease, paint, and solvent wastes will result during construction activities from the use of oils, lubricants, paints, cleaning materials and various other oil-based products. These wastes could reach the nearsite waterways as a result of leaks from construction equipment, spillages in storage areas or during transfer operations, and from maintenance areas and parking lots. Oil-based products reaching the lake and streams in runoff would adversely affect plankton, nekton, and benthic invertebrates. Certain pesticides and herbicides can be extremely toxic to aquatic organisms. The applicant should contact the USEPA and appropriate State agencies prior to using pesticides or herbicides.

4.840
A major source of liquid waste which could adversely affect aquatic ecosystems can result from concrete batch plant operation. Wastewater from plant equipment cleaning, floor washdown, truck cleaning, materials storage area runoff, and accidental spills can be carried to Lake Erie and onsite streams by runoff. The primary pollutant parameters that would affect aquatic organisms are suspended and settleable solids. The applicant has not formulated plans to minimize the impact of the aforementioned liquid wastes on the receiving waterways and their biota during construction. In light of this lack of proper control plans, Corps staff finds the impact on aquatic ecosystems as a result of construction activities to be unacceptable.

4.841
The small tributaries to Lake Erie which lie to the east of Turkey Creek are extremely small with very erratic flow. Fishes have not been noted in any of the numerous observations of these tributaries, and the steep drops at their mouths probably preclude effective migratory interfaces with Lake Erie. Existing benthos and fish populations (if present) would be adversely affected by the above mentioned impacts. The major impacts would be borne by Turkey Creek and its tributaries, Conneaut Creek and Lake Erie. These waterways do support diverse populations of a nekton, plankton, and benthos. A more extensive discussion of construction impacts on Turkey Creek is presented later in this section.

Intake/Outfall Pipe Installation

4.842
Installation of the intake/outfall pipe in Lake Erie is expected to require blasting for construction of the trench, removal of loosened materials, and backfilling once the pipes are in place. Blasting will stun some fish in the immediate vicinity of the blasting sites and some mortalities will probably occur. The blasting area nearshore has shown large concentrations of postlarval fish during the Spring and Summer of 1977. Benthos, ichthyoplanton, and zooplankton in the immediate vicinity of pipelaying activities and in surrounding waters within the shock area will be destroyed by blasting or materials removal. Recolonization of benthos would be expected within one year after back filling, although full diversity might take somewhat longer to achieve. Zooplankton have shore regeneration times and the one time loss of individuals should be insignificant. The most significant potential impact is the loss of ichthyoplankton. This is due to their mode of reproduction, longer generation times, and importance in the food chain. Corps staff intends to recommend permit conditions to minimize blasting impacts.

These include the use of advanced blasting techniques, blasting mats, deployment of fish barriers (net curtains) around the blast site and measures to dispel fish from the site prior to detonation. Additionally, no blasting should be allowed in nearshore areas (10 feet of water or less) during the critical fish spawning periods. Blasting must also conform to U.S. Army Corps of Engineers Manual "Safety - General Safety Requirements" EM 385-1-1 dated 1 March 1967, including the change dated 27 March 1972.

4.843
The degree of impact associated with the removal and backfilling of material in the trench for the new pipes will depend in part on the amount of sediment resuspended or redistributed in the area. Present observations indicate some buildup of sediments in the nearshore area decreasing rapidly with distance from shore. Amounts of sediment in the areas of Lake Erie sampled were insufficient to allow the use of Ponar dredges for benthos sampling. Sediments present may be resuspended. If these increase any limiting nutrients in the water column, algal productivity could increase. However, sustained, increased turbidity could also lower productivity at this trophic level. It is not clear whether nutrients or light presently limit production in the area. Suspended materials will most likely be carried east by currents and deposited further downdrift. Blanketing of some benthos populations in these areas is possible, and likely in areas immediately adjacent to the pipelaying. Since observed sediment levels are relatively low, this effect is not expected to be large.

4.844
Finally, contaminants such as heavy metals can be redistributed when sediments are disturbed. Metals, oil, grease, and other toxic materials present in typical lake sediment can be damaging to aquatic organisms at high concentrations or long exposure times. Sediments analyzed from the area near the pipelines (LE 5 to LE 9) exceed recommended EPA Region V criteria for lead, zinc, mercury, TKN, ammonia, iron, and nickel. While it is difficult to predict the effect of redistributing these sediments in an area such as this where sediment amounts are small and flushing is good, effects on water quality and aquatic biota are not expected to be large.

4.845
The applicant has not provided information relative to immediate dissolved oxygen demand, chemical oxygen demand, or biochemical oxygen demand of the sediment. Additionally, no analysis of polychlorinated biphenyls (PCB) was provided.

Shoreline Stabilization

4.846
During the construction phases of the proposed facility a limited amount of shoreline stabilization is planned. This would consist of riprap for 100 to 200 feet along the shoreline where the intake/outfall structures enter the lake.

4,847
Construction activities would increase suspended sediments in the nearshore area. Riprap could attract fish populations by providing interstices and substrate for benthic fauna.

4.848
If in the future further stabilization is required, the degree of impact will depend upon the type of stabilization used and the amount of shoreline treated. Sheet piling and cellular bulkheads could cause scouring of the nearshore areas 5 to 10 feet offshore of their locations. Loss of existing sediments and subsequent decreases in benthos populations would probably result. Concrete bulkheads could also decrease nearshore habitat for benthos and fishes. The fourth possible type of shore stabilization is riprap. This tends to collect benthos and attract certain fish species.

Pier Extension/Pier Construction and Dredging

4.849
Pier extension at the eastern end of Conneaut Harbor would be accomplished in the first construction phase, with a new pier being added during the second phase. Dredging of this area would also occur during the second phase, and maintenance dredging is expected to be required at some interval thereafter. The major impacts would be due to resuspension of botton sediments and habitat loss. Under the original proposal, approximately 1,114.8 square meters (12,000 square feet) of benthic habitat would have been permanently occupied by the extension. The originally proposed new pier would have eliminated an additional 3,065.7 square meters (33,000 square feet) of habitat.

4.850
The new, open-type pier proposal will reduce the amount of bottom habitat occupied by approximately one-half of that required by the original proposal. Under the new plan, 600 square meters (6,460 square feet) of bottom habitat will be occupied by the pier extension and 1,456 square meters (15,672 square feet) will be occupied by the new dock. Those benthic organisms inhabiting the area will be destroyed during construction by filling. Turbidity generated by

pile driving activities will affect fish, ichthyoplankton, zooplankton, and phytoplankton in the area. Some fish, ichthyoplankton, and zooplankton may suffer mortality. Redistribution of sediment will have impacts similar to those described for construction of the intake/discharge pipeline. However, the localized suspension and redistribution of sediment would be more significant in the enclosed area than in the open lake.

4.851
Certain heavy metals and nutrients concentrations in the harbor sediment are elevated and exceed USEPA Region V guidelines. This is possibly due to the proximity of urban development, including raw material storage areas and sewage treatment outfalls. Furthermore, sediment levels of these materials were found to be higher in the spring than later in the summer. This may have been due to increased transport from Conneaut Creek with elevated spring runoff. Iron levels were relatively high in Summer and Spring of 1977, and could be classified in the "heavily polluted" range by USEPA, Region V Criteria. (4-76) Chromium, nickel, zinc and mercury levels were elevated in the spring. Oils increased to "moderately polluted" levels during August sampling. Zinc and nickel were still in the "polluted" range, while chromium and mercury were in the "nonpolluted" range. Suspension of sediments causes adsorbed or dissolved contaminant redistribution into surrounding waters where the contaminants can be exposed to any number of alterations. These may make them more or less available to different populations of aquatic biota, especially in the water column and nearfield benthos. (4-77) The effects of some of these contaminants can be greatly increased through bioaccumulation of toxic elements and biomagnification up through the food chain.

4.852
In general, without specific testing and monitoring, it is difficult to predict the exact effect of redistributing sediments in a particular situation. However, several observations can be made about the specific construction area. Iron levels were high in 1977, and, with resuspension, iron oxide flocs could be formed. Such a situation may have occurred in Conneaut Creek in June 1977, when a fish kill was noted in the area of bridge construction. Redish flocs were noted in the area and covering the gills of dead fish, and total iron levels in the water column were in excess of three ppm. Cadmium can more easily enter solution than some other metals, but levels in the harbor sediment were below detection limits in August 1977. Mercury levels were somewhat elevated in the harbor in May 1977, and with appropriate bacterial types, (which are very widely distributed), the amount of the toxic methylated form of mercury could increase or remain about the same.

4.853
Construction of the piers is not expected to cause large amounts of long-term sediment resuspension. However, sampling in this area has indicated that it is a fish spawning and nursery area, and an area where many lake species adults congregate (presumably to feed). Ichthyoplankton sampling in 1977 indicated populations of larval gizzard shad, yellow perch, and rainbow smelt larvae, among others. Samples were almost twice as large, in late June, as those collected in nearshore areas outside the harbor. Larval and juvenile forms are in general much more susceptible than adults to effects of siltation and toxicants. While toxicant levels and sediment levels in the water cannot be accurately predicted, adverse effects on these younger forms may occur, especially during any late spring construction. (4-75) Benthos populations along the inner edge of the breakwater in 1977 consisted of facultative organisms such as oligochaetes and chironomids. Adverse impacts on this type of benthos are expected to be temporary. However, such conditions may well lead to the reduction of the productivity of this area in terms of finfish spawning/nursery habitat. In addition, the inability to sample compacted sediments in the proposed construction location has precluded determination of whether or not a more diverse, less facultative community exists in those sediments. Such might be expected in contrast to the silt-adapted community of the breakwall margin.

4.854
Due to the shallowness of the area and the siltation which occurs under baseline conditions, it is expected that periodic maintenance dredging would be required. A larger region would be affected by this activity than directly impacted by pier construction. Thus, the types of impacts discussed above would be magnified. Furthermore, the potential for oxygen depletion would be increased by increased water depth and reduced circulation. Thus, repeated maintenance dredging could possibly have greater overall adverse impacts than the initial channel formation. A reduction in dissolved oxygen below levels required by fish species, benthic invertebrates, zooplankton, and ichthyoplankton would result in loss of these organisms. It is not possible to predict the particular species and numbers of organisms which will be lost as a result of oxygen depletion during each period of maintenance dredging since the loss will depend on numerous interrelated biological, chemical, and physical parameters at the time of dredging and the amount of dredging required. The losses associated with oxygen depletion will occur on a one-time basis with each dredging episode. Lowered oxygen tends to increase toxicity of a number of the heavy metals. In addition, resuspension of larger amounts of anaerobic sediments with a significant fraction of organic material (likely because of high organic levels in Lake Erie and the sewage outfall in the harbor) could create a high oxygen demand. In an area such as this, with limited circulation, it is likely that lower oxygen levels could result during dredging operations. (4-77)

4.855
Impacts of dredging on overall benthic productivity are expected to be transitory. Populations, especially the facultative ones present in this area, typically repopulate a dredged region in less than a year. (4-77) Thus, the frequency of required maintenance dredging is an important variable. Alteration of depths and suitable substrate within the harbor will cause major impacts to fish populations since dredged channel (220,000 square feet) will most likely be lost as fish spawning habitat. If this eastern area of the harbor is dredged in the spring or early summer, impacts on that year's fish crop are expected to be much greater due to the increased presence of juvenile forms than during other seasons sampled in 1977. The section of the harbor impacted by these activities represents approximately one-third of the total harbor area of similar depth. Although no sampling was done in the corresponding western section, it is expected that this latter region also supports spawning/nursery/feeding activities by similar fish populations. Sampling in Ashtabula Harbor supports this hypothesis. (4-78)

Alteration of Turkey Creek

4.856
Orginally the applicant proposed to divert Turkey Creek into Conneaut Creek in an effort to make the most efficient use of the available land. As an alternative to the diversion plan, the applicant also proposed a scheme that would have relocated the confluence of Turkey Creek with Lake Erie, approximately 2.2 miles east of its present location. Government agencies and the general public opposed both of these proposals. The majority of the concerns centered on the loss of productive aquatic habitat, impairment of surface drainage, and the reduction of water quality in Conneaut Creek. In response to these objections, the applicant has abandoned both of the above plans and now proposes to culvert a 7,500-foot segment of Turkey Creek. This proposal specifies that the upper watershed corridors and the lower 1,500 feet of creek bed will not be altered by diversion and channeling activities or by filling. A brief summary of impacts relative to the diversion and relocation plans is provided below. A detailed impact discussion of the original proposal is included in the Draft Environmental Impact Statement.

Original Proposal

4.857
The diversion plan as originally proposed for Turkey Creek would have required the displacement of 33,000 feet of existing streambed including the mainstem and all tributaries between the diversion channel and Lake Erie (the 16000' diversion channel would have

extended westward from Rudd Road to Conneaut Creek). Since the Turkey Creek watershed totals 91,000 feet in length, approximately one-third of the entire system would have been altered. The stream length after filling and diversion would have been about 74,000 feet. The habitat that would have been lost supports diverse populations of fish and macroinvertebrates, is utilized by certain fish species for spawning, and is integral to Turkey Creek's salmonid stocking program carried on by both Ohio and Pennsylvania. Terminal pool zones, such as the one at the mouth of Turkey Creek, are critical to the integrity of Lake Erie's ecosystem and should not be considered expendable. Finally, increased siltation, unstable upstream flow patterns, and lack of stream-like cover within the 16000-foot drainage ditch would have created potentially intolerable stress conditions for the remaining creek biota. Essentially the stream would have served more as a drainage ditch than an aquatic ecosystem.

Alternative Proposal to Relocate Turkey Creek

4,858
The alternative plan to relocate Turkey Creek was also subject to agency and general public objection. In general, the plan called for the construction of a north-northeasterly meandering channel totaling 16000 feet and terminating 2.2 miles east of its present location in Lake Erie. This newly created channel was to partially compensate for the displacement of 33,000 feet of existing streambed described in the above paragraph. Mitigation plans for streambed/habitat development were also included in the plan and are described in Chapter Six.

4.859
To comparably restore the new channelized portion to a level of biological productivity that presently exist in the terminal portion of Turkey Creek was considered very remote. Unstable streambank and streambed conditions in conjunction with stream flow patterns exhibiting high energy surge periods would have resulted in serious erosion and siltation problems. Further, the absence of riparian habitat, a habitat component that for many streams acts as a buffering system, would subject stream biota to a highly variant water temperature. The combined effect of these and other factors would have precluded the successful establishment of biological communities. Overall success of this venture would have been marginal at best.

Current Proposal

4.860
Under the current proposal, the applicant plans to culvert Turkey Creek between State Line Road and a point approximately 460 meters

(1,500 feet) upstream of Lake Erie. Approximately 7,500 feet of streambed would be altered to effect the installation of a culvert 5,600 feet in length. The difference of 1,900 feet results from the straightening of bends and meanders within the mainstem and midstream tributaries. A more detailed description is included in Chapter One. Mitigation proposed under the current plan includes:

(1) Stream habitat improvements downstream from the site of the proposed culvert, to be accomplished by U. S. Steel Corporation in accordance with Ohio Division of Wildlife specifications, in an effort to establish areas suitable for successful rainbow trout spawning. This could involve the creation and maintenance of permanent pools and gravel beds as spawning sites.

(2) Augmentation of streamflow downstream from the site of the proposed culvert by diverting a portion of the pumped intake water from Lake Erie. It would be possible to maintain year-round flow; thus, enhancing the suitability of lower Turkey Creek as salmonid habitat.

(3) Preservation of the aquatic ecological community and stream-oriented terrestrial communities upstream from the site of the proposed culvert within the U. S. Steel Corporation's property. The undisturbed portions of Turkey Creek and its tributaries would be available to Pennsylvania Fish Commission personnel for aquatic studies and for management of aquatic organisms.

(4) Permission for fisherman access by boat to the eastern breakwater and to the mouth of Turkey Creek and the contiguous beach areas. If concensus is reached among resource agencies that upper Turkey Creek should be improved for salmonids, the mitigation would include the culvert plus flow augmentation and habitat improvement in the upper portions of the creek.

Construction phase impacts associated with the current proposal are presented below. Impacts during plant operation are discussed later in this chapter. For the purpose of this discussion, any changes in flow, drainage, erosion rates, water quality, or aquatic biota which occur after installation of the culvert and occur as a result of the culvert are assumed to be operational impacts. Comments received from various Federal and State Resource agencies in respect to the mitigation are presented in Chapter Five.

4.861

Culvert construction would be completed during the summer months when low flow conditions prevail; a procedure which would significantly reduce the potential for interference with critical life stages of Lake Erie fish species and resident fish species. However, implicit with the culverting plan is permanent alteration of 7,500 feet of existing streambed. For all intensive purposes, biological productivity would be extirpated within the culverted segment. Further, riparian habitat adjacent/contiguous to the proposed culvert would be eliminated.

4.862

Sampling Stations TC2, TC3, and TCT1 are situated within the proposed construction zone. Habitat in each of these sites is generally characterized by riffles, pools, undercut banks, and substrate consisting of varying amounts of silt and sand to areas composed primarily of gravel. Snags are common in many of the smaller pools, and adjacent riparian growth provides abundant shade along most of the stream's perimeter. Water transparency is very good except during periods of heavy runoff. Judging from the quality of habitat and the adult fish collection results presented in Chapter Two, the segment proposed for culverting represents high quality fishery habitat in Turkey Creek. More than 80 percent of all rainbow trout collected during the sampling program were retrieved from the three sites to be altered. Station TC3 accounted for 73 percent (221) of the total rainbow trout catch and except for the terminal pool, Station TC2 and TC3 had the highest number of individuals (all species) and taxa of all sites sampled. Loss of this portion of Turkey Creek could reduce stream productivity, particularly fishery resources. However, the loss could be partially offset by habitat improvement and habitat management in unaffected reaches of the creek.

4.863

The time of year at which the culvert is installed would determine the number and type of fish species affected. Turkey Creek interfaces with Lake Erie, but the use of this creek by Lake Erie species varies by season. Data from the Aquatic Ecology Associates (AEA) sampling program in 1977, indicates decreased diversity in numbers of fishes in summer samples when compared to April and May sampling efforts. This appeared to be due, in part, to lowered numbers of Lake Erie migrants. Common white sucker (*Castostomus commersoni*), golden redhorse (*Moxostoma erythrurum*), shortheaded redhorse (*Moxostoma macrolepidotum*), northern hog sucker (*Hypentelium nigricans*), rainbow trout (*Salmo gairdneri*), northern pike (*Esox lucius*), grass pickerel (*Esox americanus vermiculatus*), and brown bullhead (*Ictalurus nebulosos*) are examples of species found in Turkey Creek in April and May that could have been on spawning runs

from the lake. Spawning was verified for common white suckers and is certainly possible for the others listed. These species which may spawn in Turkey Creek were also found in Raccoon and Conneaut Creek, with the exception of northern pike (found only in Turkey Creek) and grass pickerel (collected in Turkey and Conneaut Creeks). However, it is quite possible that all of these creeks are at carrying capacity in terms of spawning habitat for many of these species and would be unable to handle any fish displaced from Turkey Creek as a result of instream construction activities which result in high levels of total solids and siltation. This would be especially true for the salmonids, grass pickerel, and northern pike where relatively little spawning habitat exists in the lake basin. Rock bass, (Ambloplites rupestris), smallmouth bass (Micropterus dolomieui), and freshwater drum (Aplodinotus grunniens) were also observed in the lower portions of Turkey Creek in the Spring of 1977, and numerous juvenile largemouth and smallmouth bass were collected throughout the creek during the Summer and early Fall of 1977. These may have ascended the stream for food or shelter. Species of sunfish, darters and other forage fishes have been present throughout Turkey Creek during all sampling efforts to date. Salmonids are reported to occupy the pool adjacent to State Line Road during the winter months. (4-79) Construction during this period could destroy those individuals in the pool. Therefore, culvert construction would be completed during the summer months to reduce the potential for interference with critical life stages of Lake Erie fish species and resident fish species.

4.864
Preparing the streambank for installation of the culvert would require the removal of streambank vegetation along the effected reaches of Turkey Creek. This would cause elevations in water temperature by eliminating stream shade during warmer months of the year. Elevated temperatures would affect especially sensitive species, such as the salmonids. Such differences have been recorded in existing shaded versus nonshaded, areas of Turkey Creek by Aquatic Ecology Associates: the well-shaded, shallow TC2 station exhibited consistently lower temperatures (1-2° in all but one case) than the unshaded, deeper TC3 station. Similarly, Duval et. al. (4-81) observed 1.1 to 1.7°C differences in July water temperatures between shaded and channelized sections of several other small streams in Pennsylvania. (4-84, 73, 80) The ability of water to maintain acceptable dissolved oxygen levels decreases with increasing temperatures. As the temperature increases during the hot summer months, dissolved oxygen (DO) levels may fall below levels required by certain fish species, benthic invertebrates, and zooplankton. The combination of elevated temperatures and depressed DO levels would limit species diversity. After the culvert is installed, the water

will be shaded by the culvert itself and elevated temperatures should not occur. Additionally, fill will be placed over the culvert which will also help maintain a low water temperature during the summer.

4.865
In addition to habitat displacement, construction activities could result in adjacent bank and streambed disturbance with subsequent short-term erosion and siltation problems. Increased levels of suspended and dissolved solids could create stress conditions potentially harmful to various stream fauna and inhibit primary productivity. Further, siltation could alter substrate suitability for various benthic and periphytic organisms. The pool area with the greatest depth at the mouth of the creek is heavily used by fish and could be subject to severe impact from siltation during the construction phase unless the instream work is accomplished when upstream sections are dry or proper measures are taken to trap silt before it reaches the pool area.

Impacts Due to Erosion and Siltation

4.866
The current plan maintains vegetation around the streambed above and below the point of culverting and thus, serious erosion and siltation should not occur. However, there will be some erosion during actual culvert construction. Increased erosion around the culvert work area is expected to increase siltation and suspended materials in the creek. It is unlikely that turbidity levels will reach lethal concentrations for adult fishes. Sherk et. al. (4-75) observed sublethal effects of relative low concentrations of suspended solids on several species of estaurine fishes (Hogchoker: 1.25 ug/l, white perch, 0.65 ug/l exemplifies the range). These included hematological and histological effects similar to those of fishes exposed to low oxygen levels. The authors also concluded that the combined effect of higher metabolic rates and the finer, more efficient filters of their gill lamellae rendered juveniles of a species highly sensitive to suspended solids, regardless of the tolerance exhibited by the adult. For instance, white perch juveniles, white perch, bluefish (estuarine), and menhaden (estuarine) juveniles were affected by concentrations in the range of 0.75 to 0.8 ug/l. Herbert and Merkins (4-74) found that long exposures (2-12 weeks) to 2.7 ug/l of very fine kaolin and diatomaceous earth were lethal for over 50 percent of the rainbow trout tested. Few fishes died at 0.9 ug/l and concentrations of 0.3 ug/l had no observable effect. They also observed histological effects of higher levels of these sediments on the trout. Tebo (4-86) measured what was referred to as turbidity at 1.2 and 1.37 ug/l during rainstorms at the mouth of a tributary where clearing for logging roads and ski trails had occurred. Turbidity

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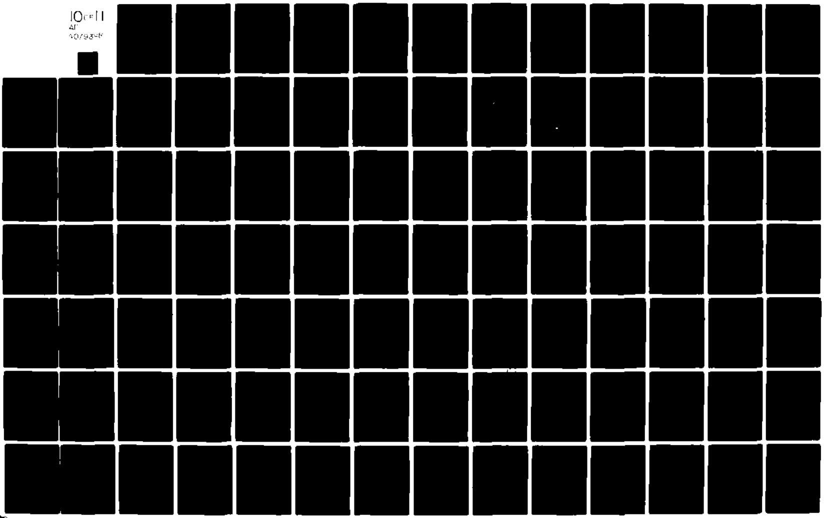


measurements of 0.025 and 0.067 ug/l, respectively, were recorded upstream above this mouth. This stream was characterized by very steep banks and a steep gradient. These observations were conducted with essentially inert materials, those with high oxygen demand or containing toxic materials such as heavy metals can have a much greater effect on fish mortality at lower concentrations. Runoff from coal and other storage areas near the western end of this ditch might contain such materials. Long periods of elevated concentrations as high as those discussed above are not expected to occur in Turkey Creek if proper erosion control plans are implemented. However, if not properly managed, runoff into Turkey Creek could contain suspended solids in the range of 0.01 to 10.0 ug/l, or higher. In addition to the impacts on juveniles discussed above, siltation can also adversely affect reproductive success of fish due to blanketing of substrate, (especially gravel and rubble) utilized for spawning. The streambed in much of existing Turkey Creek is largely scraped out of bedrock covered with large rubble and some sand or clay. This substrate has been found to be highly productive in terms of benthic fauna. Siltation or organic material can clog interstices of rock and gravel in the creek channel with nonfood source materials as well as decreasing oxygen supply for organisms. This would most likely diminish the diversity of benthos populations as well as total numbers. Station TCT2 (a tributary to Turkey Creek intersected by recent clearing and grading operations on the proposed project site by U. S. Steel subsidiaries) exhibited very reduced benthos diversity and numbers of individuals compared to other comparable stations of the stream samples collected in late April 1977 by Aquatic Ecology Associates. Approximately in order of magnitude fewer individuals and one-third or fewer the number of taxa were found at this site. As clearing in this area was begun very early in the Spring of 1977, these results are illustrative of the effects of siltation on local overwintered populations of insect larvae that make up much of the stream benthos. Although flow and oxygen levels were good in this tributary, almost none of the more sensitive Plecopteran, Ephemeopoteran or Tricopteran larvae were present. A similar observation was made by Etnier who examined benthos in an annually channelized stream. (4-74) The potential for eventual recovery of benthic populations on substrate stabilization is illustrated by the results of further sampling at the TCT-2 station. In samples collected during early October, the area just downstream of the construction site still exhibited 50 percent fewer individuals than a sample taken just upstream of the construction site. However, the species composition at the two stations was similar in the Fall (22 species), possibly indicating a gradual recovery in progress. However, only further sampling over a longer period of time could substantiate the recovery. Proper erosion control plans will greatly reduce siltation and its impact on the aquatic ecosystem.

4.867
It is assumed that the principal mode of benthos repopulation is through invertebrate drift from upstream areas. There are additions to stream populations annually from egglaying by the winged adults of many of the benthic larval species. In both instances suitable substrate and stream flow is necessary for successful population establishment. Studies by Duval et. al. (4-81) and Tebo (4-86) have illustrated rapid reestablishment of benthos populations in channelized and heavily silted streams, respectively. When substrate material consisted of larger rubble and rocks, these represented fairly stable habitat. Conversely, channelized portions of streams with heavy siltation and shifting, unstable bottoms support only severely depopulated benthic fauna. A number of investigators have observed benthos restricted to riprap and bridge abutments or obstructions in streams where unstable shifting bottoms exists as a result of channelization. (4-82, 83, 89, 90, 91) Although most of these studies were conducted in much larger bodies of water than Turkey Creek, the channelized areas investigated were 30 years old in one case and over 50 years old in two cases. Culverting could affect hydraulic perturbations in the Turkey Creek upper reaches (increased drainage rates) resulting in siltation and covering of benthic habitat. The possibility of flow augmentation during low flow periods could minimize the deposition of these materials on benthic habitat. Spring runoff and heavy rainstorms would also provide flow and velocity which would keep bottom sediments shifting.

4.868
Finally, the assumption that untouched upstream sections could serve as spawning grounds is dependent in part upon the degree of additional disturbance in these areas. Planned road construction involves these areas to the degree that increased clearing would result in erosion and siltation. Loss of these upstream areas may occur and additional time for recovery could be expected (see the Road Construction discussion in the following subsection). Increase flow resulting from culverting of the mainstem might slightly increase the drainage rate of upstream tributaries. Those tributaries exhibiting year-round flow could become intermittent while intermittent tributaries may become dry for longer periods of time. This would all tend to decrease the habitat suitability of upstream portions of Turkey Creek. Augmentation of Turkey Creek flow, if required by the resource agencies as part of the mitigation plan, could tend to create a backwater effect and reduce the culvert's impact on upstream areas. Additionally, the culvert baffling system may tend to minimize any increased drainage of upstream areas caused by the culvert.

Access Roads and Rail Line Extensions

4.869
Extensions of existing rail facilities and two new access roads are proposed in conjunction with construction of the Lakefront Plant. The major impact to stream biota would result from increases in suspended materials and sediments due to runoff from land cleared of vegetation.

4.870
The east access road, and rail lines that parallel it from the proposed location of finishing operations, would both cross the headwaters of the mainstem of Turkey Creek. Culverting for rail crossings over a major Turkey Creek tributary (TCT-2) in the central portion of the site has resulted in a significantly depauperate benthos downstream of the culvert and construction area. In fall observations this area was compared to the apparently unaffected upstream portion immediately south of the railroad culverting. More abundant macrobenthos populations were found in the latter area than the former. Opportunities for erosion from the portions of the banks around the culvert where seeding had not taken place were still apparent in October 1977, although ecological recovery may have been in progress. The portions of the western access road within the Lakefront site would not cross tributaries.

Impacts on Aquatic Biota

Operations Impacts

Impact of the Water Intake

4.871
The applicant has indicated that the location and design of the water intake will minimize the entrainment and entrapment of fish species. However, the Corps staff does not concur with this observation since field studies indicate that large numbers of ichthyoplankton will be lost if the intake is operated at this location. The design of the intake structure itself includes velocity caps covering the intake ports. With such structures, intake velocities are reduced and flow is essentially horizontal. Recirculation of water is planned for the proposed plant so that the intake flow required is 14,800 cubic meters per hour or 147 cubic feet per second (cfs). With this design, mean intake velocity is 0.26 feet per second (around 0.079 meters per second). The maximum approach velocity at the center of the port should not exceed 0.55 feet per second (around 0.166 meters per second). The volume of intake is small compared to that of large power facilities that use once through cooling but is about three times as high as a proposed 1700 MW power plant on Lake Erie which

will use a closed cycled cooling system. Intake approach velocities of 0.5 feet per second or less are recommended by the USEPA, U.S. Nuclear Regulatory Commission, and the U.S. Fish and Wildlife Service. (4-92) Ambient current velocities measured in the region of the proposed intake structure are higher than the proposed intake velocity, generally ranging from 0.45 to 0.90 feet per second. The proposed intake velocity and capacity should reduce the entrainment of plankton and impingement of adult and juvenile fish. Velocity caps would also reduce the area of the zone where the velocity of the withdrawal flow would be significant. (4-92) Operation of the proposed intake will result in the entrainment of ichthyoplankton, zooplankton, and phytoplankton. Entrainment occurs when aquatic organisms that are smaller than intake screen openings (in this case 5 x 5 cm openings) cannot successfully avoid these openings and are drawn into the plant's circulatory water system along with intake water. Due to the proposed recycling of large quantities of water the retention time of organisms entrained in the system will be high and therefore 100 percent mortality is assumed.

Applicant's Analysis

4.872
Several studies have examined the impact of a 3200-megawatt Detroit Edison power plant. This plant is located at the mouth of the Raisin River in the Michigan waters of the western basins of Lake Erie. The intake structure, located in the mouth of the river, requires cooling water from Lake Erie and the Raisin River at the rate of 110 cubic meters per second (396,000 m^3/hr) (3,887 cfs).

4.873
This is 28 times the expected volume required by the proposed steel facility. Another major difference includes the location of the power plant intake at a lake/stream interface where large numbers of lake species spawn. As such, comparison between the Lakefront Plant and this generating facility is an extreme comparison. However, the projected Lakefront Plant intake requirement is low relative to that of most electric generating facilities with documented entrainment/impingement effects of significance. Yellow perch losses were of concern in the studies conducted in the vicinity of this western basin plant because of their commercial and recreational importance. Nelson and Cole (4-93) estimated the number of yellow perch larvae potentially entrained per year as being somewhere in the range of 59.6-111.5 million fish per year based on 1974, 3000 megawatt production levels (although most of this loss would occur in the spring). Sampling biases were noted. Patterson (4-94), using data from several investigations of this same site, estimated 137.7 million perch larvae as the maximum entrained, with 85-110 million larvae being more likely. According to his approximations, this would

represent less than 5.3 percent of the larval perch produced in this portion of the western basin. Of this number, 7 to 31 million might have survived to become juveniles. In an additional paper, Patterson (4-95) approximated a "long run" annual loss of 98,000 pounds of yellow perch to the western basin fishery and/or production of the next generation. The applicant's consultant has stated that with the much smaller volume, and the less important offshore intake location for the proposed steel facility, numbers of fish several orders of magnitude below those entrained at a facility like the Detroit Edison plant are expected. Rainbow smelt is expected to be the most abundant species near the intake. An extended offshore storm during the late spring months could cause drifting of much larger numbers of such characteristically offshore larvae into the range of the intake ports. Entrainment of much larger numbers of larvae would occur in such a situation. The combination of the above conditions is not expected to be a frequent occurrence.

4.874
The applicant has not provided any analyses of expected entrainment losses of phytoplankton, zooplankton, or ichthyoplankton based on onsite collection efforts. The applicant has indicated that ichthyoplankton losses will be several orders of magnitude below those entrained at the Detroit facility but has made no attempt to define the relative abundance of ichthyoplankton expected in the entrainment catch or to quantify the losses. Additionally, no information was provided by the applicant relative to the loss of adult and juvenile fish as a result of impingement.

Staff Analysis

4.875
Staff analysis of entrainment losses is based on and limited by the results of the applicant's sampling effort. Sampling effort inconsistencies and data gaps make a thorough analysis difficult. As an example, ichthyoplankton sampling in the vicinity of the proposed intake structure was performed solely during the daytime for the first half of the sampling period and strictly at night for the second half.

Phytoplankton and zooplankton results are available for the period from spring to fall but no winter data were provided.

Entrainment

Phytoplankton

4.876 Phytoplankton mean densities in the vicinity of the intake structure (LE-9) are available for April, May, June, and August.

Staff has calculated entrainment losses based on the mean phytoplankton densities during these months and the entrainment of 1.065 X 10^7 cubic meters of water per month (14,800 m^3/hr). The estimated entrainment losses are shown below:

Month	Phytoplankton Mean Density (cells/ml)	Estimated Entrainment (cells/mo)	Dominant Taxa Entrained
April	365	3.88 X 10^{15}	Chrysophyta
May	8238	8.78 X 10^{16}	Chlorophyta, Cryptophyta
June	1356	1.44 X 10^{16}	Cryptophyta
August	3497	3.72 X 10^{16}	Chrysophyta, Chlorophyta
Total		1.43 X 10^{17}	

4.877
If the total losses of these four months were projected for the entire year, the yearly loss would be 3 times 1.43 X 10^{17} or 4.29 X 10^{17} cells per year. However, cell densities would probably decrease during some of the winter months and fluctuate in late winter. The yearly estimate is probably a high estimate. Phytoplankton have a turnover rate of a few hours to a few days and can recover from these entrainment losses rapidly. No significant impact on phytoplankton population is anticipated.

Zooplankton

4.878
Zooplankton entrainment estimates were based on sampling performed on 26 April, 22 June, and 16 August at station LE9. The densities used

were the average of surface and bottom sampling efforts. The calculated month entrainment rates are as follows:

Month	Zooplankton Density (No./ 1)	Estimated Entrainment (No./month)	Relative Abundance at Sampling Station (Percent)
April	356.74	3.80×10^{12}	78.9 Rotifer 14.2 Protozoa 6.5 Copepoda 0.2 Cladocera
June	1577.46	1.68×10^{13}	53.9 Cladocera 31.2 Rotifer 7.3 Protozoa 7.6 Copepoda
August	1250.50	1.33×10^{13}	88 Protozoa 10.3 Rotifer .8 Coperpoda .6 Cladocera
Total (3 months)		3.39×10^{13}	

4.879
The staff estimation of zooplankton entrainment was based on the assumption that zooplankton will be non-selectively entrained. In actuality, some of the larger zooplankton may be able to avoid entrainment due to their swimming ability. Staff has made no attempt to estimate annual losses based on the limited number of months sampled and the lack of sampling for diel migrations. Assuming 100 percent mortality, entrained zooplankton will be removed from their respective populations. Dead organisms discharged through the diffuser may still serve a function in the lake ecosystem. Those organisms remaining in suspension for a period of time could serve as food for other organisms while those settling to the bottom would eventually be decomposed and recycled as nutrient matter. The loss of zooplankton could cause shifts in species composition which would be highly localized, seasonal, and of no consequence to Lake Erie as a whole. The turnover rates of protozoa, rotifers, and microcrustaceans range from a few hours to several months.

Ichthyoplankton

4.880
The eggs, larvae, and juvenile fish which are present in Lake Erie are actually part of the zooplankton community. However, they are

generally present for only a few months in the year (mid-spring to early fall) and are considered separately from the other zooplankters. Entrainment of ichthyoplankton has the potential for triggering the greatest effects on the aquatic ecosystem as a whole. This is due to their annual reproduction mode, and their correspondingly longer generation time as well as their capacity to exploit other food chain organisms selectively and to cause shifts in community composition which may favor certain species. Individual ichthyoplankters lost from their respective community can only be replaced by their cohorts several years later when the cohorts reach sexual maturity and reproduce. Fish generally overproduce eggs and larvae which may compensate for losses accrued in each life stage by predation or disease. Entrainment of high numbers of ichthyoplankton could crop this compensatory population affecting future generations.

4.881
Corps staff has estimated entrainment losses by month, based on the withdrawal of 1.065×10^7 cubic meters of water per month and ichthyoplankton densities at sampling stations LE8 and LE9. For each month, staff has attempted to provide an estimate based on the highest density identified and the monthly mean density of LE8 and LE9 surface and bottom samples. This method provides a range of potential losses and may compensate for the periods between sample collections, when peak densities may have been missed. The baseline data used for the analysis is presented in Appendix D. The major difficulty with the estimates stems from the fact that night and day samples are interspersed throughout the sampling period and although night samples are generally higher, a quantitative analysis could not be made. The following tables show the calculated monthly entrainment rates by species. The column identified by the heading "highest estimate" was based on the highest monthly density at either LE8 or LE9, surface or bottom collection. The "average monthly loss" column was calculated using the mean monthly density at LE8 and LE9 (surface and bottom samples).

Species	Type	Day or Night Sample (May)	Highest Estimate	Average Monthly Loss
Rainbow Smelt	larvae	D	5.65×10^5	1.42×10^5
Gizzard Shad	larvae	D	1.82×10^5	2.26×10^4

Species	Type	Day or Night Sample	Highest Estimate	Average Monthly Loss
		(June)		
Unidentifiable	eggs	D	1.27×10^6	7.99×10^4
		N	2.23×10^5	2.79×10^4
Unidentified minnow	eggs	D	-	-
		N	1.55×10^6	1.94×10^5
Unidentified minnow	larvae	D	1.88×10^5	1.23×10^4
		N	1.55×10^6	3.64×10^5
Freshwater drum	eggs	D	1.00×10^7	6.99×10^5
		N	1.13×10^7	2.94×10^6
Freshwater drum	larvae	D	-	-
		N	2.85×10^6	4.10×10^5
Rainbow smelt	larvae	N	4.12×10^7	7.38×10^6
		D	3.19×10^5	2.86×10^4
Gizzard shad	larvae	D	-	-
		N	8.95×10^5	2.82×10^5
Carp	larvae	D	-	-
		N	1.12×10^6	3.81×10^5
Trout-perch	larvae	D	-	-
		N	2.34×10^5	5.72×10^4
Rainbow darter	larvae	D	-	-
		N	2.66×10^5	3.33×10^4
Unidentified darter	larvae	D	-	-
		N	1.19×10^6	2.02×10^5
Yellow perch	larvae	D	4.79×10^5	3.99×10^4
		N	1.91×10^5	2.39×10^4
Log perch	larvae	D	2.34×10^6	8.39×10^4
		N	8.41×10^5	1.65×10^5
Unidentifiable	larvae	D	-	-
		N	2.13×10^5	2.66×10^4
Trout-perch	juveniles	D	-	-
		N	2.34×10^5	5.59×10^4
		(July)		
Freshwater drum	eggs	N	2.09×10^6	3.07×10^5
Freshwater drum	larvae	N	3.94×10^5	1.56×10^5
Gizzard shad	larvae	N	1.33×10^6	3.48×10^5
Gizzard shad	Juveniles	N	2.67×10^6	3.85×10^5
Rainbow smelt	larvae	N	9.48×10^5	2.43×10^5
Rainbow smelt	Juveniles	N	2.02×10^5	1.26×10^4
Log perch	larvae	N	2.02×10^5	2.53×10^4
Log perch	Juveniles	N	9.05×10^5	6.85×10^4
Unidentified minnow	larvae	N	2.17×10^7	3.04×10^4
Unidentified minnow	Juveniles	N	7.42×10^6	7.66×10^6
Spottail shiner	Juvenile	N	6.39×10^4	3.99×10^3
Unidentified darter	larvae	N	2.02×10^5	3.92×10^4
Carp	larvae	N	3.99×10^6	4.94×10^5

Species	Type	Day or Night Sample	Highest Estimate	Average Monthly Loss
		(August)		
Unidentified	eggs	N	5.33×10^5	3.33×10^4
Rainbow smelt	larvae	N	2.82×10^6	4.74×10^5
Rainbow smelt	Juvenile	N	3.87×10^6	8.74×10^5
Unidentified minnow	larvae	N	3.62×10^5	3.39×10^4
Unidentified minnow	Juvenile	N	9.59×10^6	8.19×10^5
Unidentified cyprinid	larvae	N	1.76×10^6	2.13×10^5
Spottail shiner	Juvenile	N	1.21×10^6	1.20×10^5
		(September)		
Rainbow smelt	Juveniles	N	3.36×10^6	9.32×10^5

(October)

No ichthyoplankton collected.
LE-9, night sample only

(November)

No ichthyoplankton collected.
LE-9, night sample only

(April 1978)

Night sample only. No ichthyoplankton collected at LE 8 or LE 9

4.882
The total ichthyoplankton monthly losses based on the above entrainment rates are shown below.

	Day or Night Sample	Highest Losses	Average Monthly Loss
May	D	7.46×10^5	1.64×10^5
June	D	13.59×10^6	9.4×10^5
	N	63.83×10^6	12.35×10^6
Average D&N		38.71×10^6	6.64×10^5
July	N	42.10×10^6	5.40×10^5
August	N	20.14×10^6	2.57×10^6
September	N	3.36×10^6	9.32×10^5

4.883
The estimates of entrainment for May are probably low since these were based entirely on daytime samples and ichthyoplankton densities are generally highest at night. However, the estimate for the months of June, July, and August are overestimates since nighttime densities were used to calculate entrainment and were assumed to occur for a 24-hour period each day.

4.884
Rainbow smelt, minnows (unidentified), freshwater drum, gizzard shad, and carp are expected to suffer the highest losses. Staff estimates that during June alone, rainbow smelt losses could range from 3.7×10^6 to 20.7×10^6 larvae. This value was derived by assuming the maximum and average daytime entrainment rates for one-half of the month and the nighttime rate for the remaining half of the month. Rainbow smelt entrainment is expected to occur during each month from May through September. Freshwater drum entrainment is also expected to be high during June ranging from 1.82×10^6 to 1.06×10^7 eggs and between 2.05×10^5 to 1.42×10^5 to 1.42×10^6 larvae. Freshwater drum will also be entrained during July but in lower numbers.

4.885
Unidentified minnow larvae and juveniles and carp larvae are the taxa showing highest losses during July. Since daytime collections were not made, actual monthly entrainment is difficult to estimate. However, the losses will probably be lower than shown on the above charts. Based solely on nighttime samples, rainbow smelt will be the species entrained in highest numbers during August, followed by unidentified minnow larvae and juveniles. Based on the sampling results, the highest loss of yellow perch larvae will occur during the month of June. Although yellow perch is not expected to sustain losses as high as minnow, smelt, freshwater drum, or gizzard shad, its entrainment merits concern since it is an important sport and commercial fish.

4.886
Staff suspects that based on the available sampling results, entrainment of freshwater drum, rainbow smelt, and minnow could be high enough to affect local populations of these species. The draft EIS stated that due to the anticipated entrainment losses, the location of the intake structure should be subject to further evaluation. Comments on the draft EIS from the USEPA, U.S. Fish and Wildlife Service, National Marine Fisheries Service, Pennsylvania Department of Environmental Resources, Pennsylvania Fish Commission, and Erie County Health Department supported staff's position regarding re-evaluation of the intake location. Most of these agencies advised that additional ichthyoplankton sampling should be performed to

determine the final location of the intake structure. The USEPA indicated that the U.S. Fish and Wildlife Service would provide expertise in selecting the species, sampling location, and period for additional sampling and that the additional data will be reviewed prior to final approval of the intake. Final design and location will be determined at a future date through the NPDES permit program. On 9 January 1979, U.S. Steel agreed to perform the additional sampling as requested by USEPA.

4.887
On 18 January 1978, Corps staff met with representatives of the U.S. Fish and Wildlife Service, the Pennsylvania Fish Commission, and the U.S. Steel Corporation to discuss a scope of work for additional ichthyoplankton sampling. Subsequently, U.S. Fish and Wildlife Service developed the scope of work which is summarized below:

- Ichthyoplankton samples are to be collected at five stations along the water intake transect line of the proposed U.S. Steel Lakefront Plant. Final siting of the proposed water intake structure will be based, in part, upon analysis of the data generated in this survey. Sampling sites are to include the presently proposed water intake site (30-foot depth contour) and two possible alternative sites (35-foot and 40-foot depth contours). Samples are also to be collected at two nearshore stations (10-foot and 20-foot depth contours).

- Statistical comparisons between the nearshore and offshore areas and between individual stations are to be performed based upon the total abundance of all larvae as well as upon the abundance of selected taxonomic units. These taxonomic units will be selected upon inspection of the data by the concerned resource agencies in concert with the sampling agency and will include species of sport and commercial importance, State endangered species, and selected forage species.

- The sampling agency, in consultation with a qualified biometrician, will select appropriate methods for statistical analysis of the data to determine statistical distribution of the larvae. Final analysis of the data will be coordinated with the U.S. Fish and Wildlife Service.

- Samples are to be collected every seven days beginning 16 April 1979, and ending 13 August 1979, resulting in 18 discrete sampling days.

- Samples are to be collected only at night, starting approximately 45 minutes after legal sunset.

- Four oblique tows are to be performed at each sampling station on each sampling day. Tows should be parallel to shore and should alternate in towing direction whenever possible.

- Voucher specimens are required, and during identification no samples are to be subsampled.

4.888
The scope of work specifies field procedures, laboratory procedures, type of data presentation, and the identifiable taxonomic units to be used. A copy of the scope of work is presented in Appendix D.

Impingement

4.889
The water entering the intake structure will draw aquatic organisms into the plant water system. These organisms, principally fish, that are larger than the 5 CM screen openings will be drawn against the screen and impinged. Considering the size of the openings, most adult fish would be impinged while juveniles and young-of-the-year would become entrained. Quantitative predictions of fish impingement are difficult to assess because physical and biological factors tend to interact to influence the species and numbers impinged. The fish species habitat preference in relation to the intake location is important in determining whether that particular species will be impinged. In the case of the proposed steel plant, the intake will be located at about the 30-foot depth contour. The applicant's sampling stations representative of the 30-foot contour are LE9, LE10, and LE13. Station LE8 is at the 25-foot contour in the vicinity of the proposed intake structure. The relative abundance of fish species at the 30-foot contour and at LE8 is shown below for the sampling period from April 1977 to November 1977.

LE-8 - Total Number Gill Netted

	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Total	Percent Total
Yellow perch	15	80	23	46	24	21	6	4	219	39.8
Gizzard shad	-	-	-	10	27	69	66	5	177	32.2
White bass	-	-	-	-	-	23	29	5	57	10.4
Freshwater drum	10	5	5	13	5	2	5	-	45	8.2
White sucker	-	1	-	-	1	8	5	3	18	3.3
Walleye	-	-	1	-	1	4	-	-	6	1.0
Smallmouth bass	-	-	1	2	?	-	-	-	5	0.9
Rock bass	-	1	1	-	-	1	-	-	3	0.6
All others and above species									550	100.0

LE-9 - Total Number Gill Netted

	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Total	Percent Total
Yellow perch	6	178	80	199	37	28	1	4	533	65.3
Gizzard shad	-	-	-	6	18	37	68	10	139	17.0
White bass	-	-	-	-	5	29	37	4	75	9.2
Freshwater drum	-	4	8	3	11	-	1	-	27	3.3
White sucker	-	-	7	3	2	4	-	4	20	2.5
Rock bass	-	2	-	1	-	-	3	1	7	0.9
Walleye	-	-	-	-	1	2	-	-	3	0.4
All others and above species									816	100.0

LE-10 - Total Number Gill Netted

	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Total	Percent Total
Yellow perch	5	71	39	42	21	16	3	-	197	48.2
Gizzard shad	-	-	-	-	7	15	73	17	112	27.4
Freshwater drum	1	1	4	10	5	1	4	1	27	6.6
Walleye	-	-	-	-	21	2	2	1	26	6.4
White bass	-	-	-	-	3	8	3	3	17	4.2
White sucker	-	-	4	-	1	1	1	1	8	2.0
Rock bass	-	-	4	1	2	-	-	-	7	1.7
Smallmouth bass	-	-	5	1	1	-	-	-	7	1.7
All others and above species									409	100.0

LE-13 - Total Number Gill Netted

	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Total	Percent Total
Yellow perch	X	X	X	147	60	X	X	X	207	88.8
Gizzard shad	X	X	X	-	13	X	X	X	13	5.6
Freshwater drum	X	X	X	5	4	X	X	X	9	3.9
All others and above species									233	100.0

X - no sampling performed.

4.890
The most abundant species in decreasing order of abundance were yellow perch, gizzard shad, white bass, freshwater drum, white sucker, walleye, rock bass, and smallmouth bass. The total catch at

the four stations during the entire sampling period was 2,008 individuals including 1,156 yellow perch (57.6 percent), 441 gizzard shad (22.0 percent), 149 white bass (7.4 percent), 108 freshwater drum (5.4 percent), 46 white sucker (2.3 percent), 35 walleye (1.7 percent), 17 rock bass (0.8 percent), and 12 smallmouth bass (0.6 percent). All other species collected accounted for about 2.2 percent of the total catch. The results of all gill net stations (LE1 through LE15) also show yellow perch, gizzard shad, white bass, white sucker, and freshwater drum as the most abundant species. The Corps of Engineers staff believes that these species will account for the majority of the impingement catch. Gill nets results do not account for small forage species, such as emerald shiner, which may be in the area of the intake. However, due to the size of the originally proposed intake screen openings, most small fishes would have been entrained in the system rather than impinged on the screens.

4.891
The most abundant small species in the project area as demonstrated by nearshore seining were spottail shiner, emerald shiner, longnose dace, trout-perch, log perch, and striped shiner.

4.892
Studies at operating power plants in the central basin of Lake Erie have generally indicated that gizzard shad, alewife, emerald shiner, white bass, yellow perch, freshwater drum, and rainbow smelt are most frequently impinged. However, at these plants, gizzard shad generally comprise about 80 percent of the impingement catch, and yellow perch and white bass less than 0.1 percent of the catch. Most of these power plants withdraw water from Lake Erie through open-ended diked channels at a significantly higher rate than that projected for the steel plant. Thus, the impingement at these plants may represent more nearshore species than can be expected in the steel plant intake. Staff estimates a higher percentage of yellow perch, white bass, and freshwater drum will be impinged at the proposed plant than were impinged at those central basin power plants. At the present time, quantitative impingement estimates are not possible based on the limited amount of data available.

4.893
Since the issuance of the draft EIS, the applicant has agreed to incorporate best available technology which has been demonstrated to be practicable in minimizing adverse effects. The USEPA has stated that wedge wire screens currently represent best technology. If that opinion prevails during the detailed design stage and during the NPDES review, the applicant will utilize such screens or an equivalent proven technology. The wedge wire screen is a surface water intake screen constructed of "V"-shaped wire on vertical rods. The

wire is helically wound on the vertical rods resulting in the formation of slots that are inward enlarging. Wedge-wire screens produce nearly uniform velocity and flow characteristics. The screens have relatively little dead area which allows for low entrance velocity while still maintaining high intake capacity. When particles or aquatic organisms are trapped against these screens, they tend to be washed away by natural currents since the intake velocity is relatively low and the smooth surface has little resistance. Impingement may be greatly reduced since these screens produce a nearly uniform flow of low enough velocity to allow most fish species trapped on the screen to escape or be washed away by currents.

Impact of Main (Combined) Wastewater Discharge

4.894
In discussing the impact of the discharged from the operation of the proposed Lakefront Plant, ambient conditions in Lake Erie need to be considered simultaneously. Parameters such as alkalinity/hardness, pH, dissolved oxygen, and temperature affect the toxicity of some discharge constituents. Current speeds will affect mixing, and hence, concentrations of toxicants. The degree of stratification may also determine the rate, or degree to which contaminants are diluted, as well as the impact of some. In addition, dissolved oxygen, temperature, growth stage and season are examples of parameters that serve to determine sensitivity of organisms as well as the likelihood that they will be located in areas that might be affected by contaminants. The degree of potential impact of contaminants at projected effluent concentrations with mixing characteristics projected for the effluent plume thus reflects a combination of Lake Erie conditions and plant operating conditions. Table 4-349 lists concentrations of certain contaminants that might be expected in Lake Erie under baseline conditions, in the effluent during normal operations and 800 feet from an outfall diffuser configuration placed at the 10-meter depth contour (refer to Figure 4-109). Specific details are listed below.

- In cases where Lake Erie concentrations were below analytical detection limits (e.g., cyanide (A) and sulfide) an estimate was made within the range of non-detectable concentrations.

- Effluent concentrations represent a "typical" 30-day average except in the case of parameters, listed by effluent concentrations were assumed to be at the "Monthly Average" limits. In practice, long-term average concentrations are expected to be lower. These were calculated in combination with typical background levels in Lake Erie intake water.

Table 4- 3??

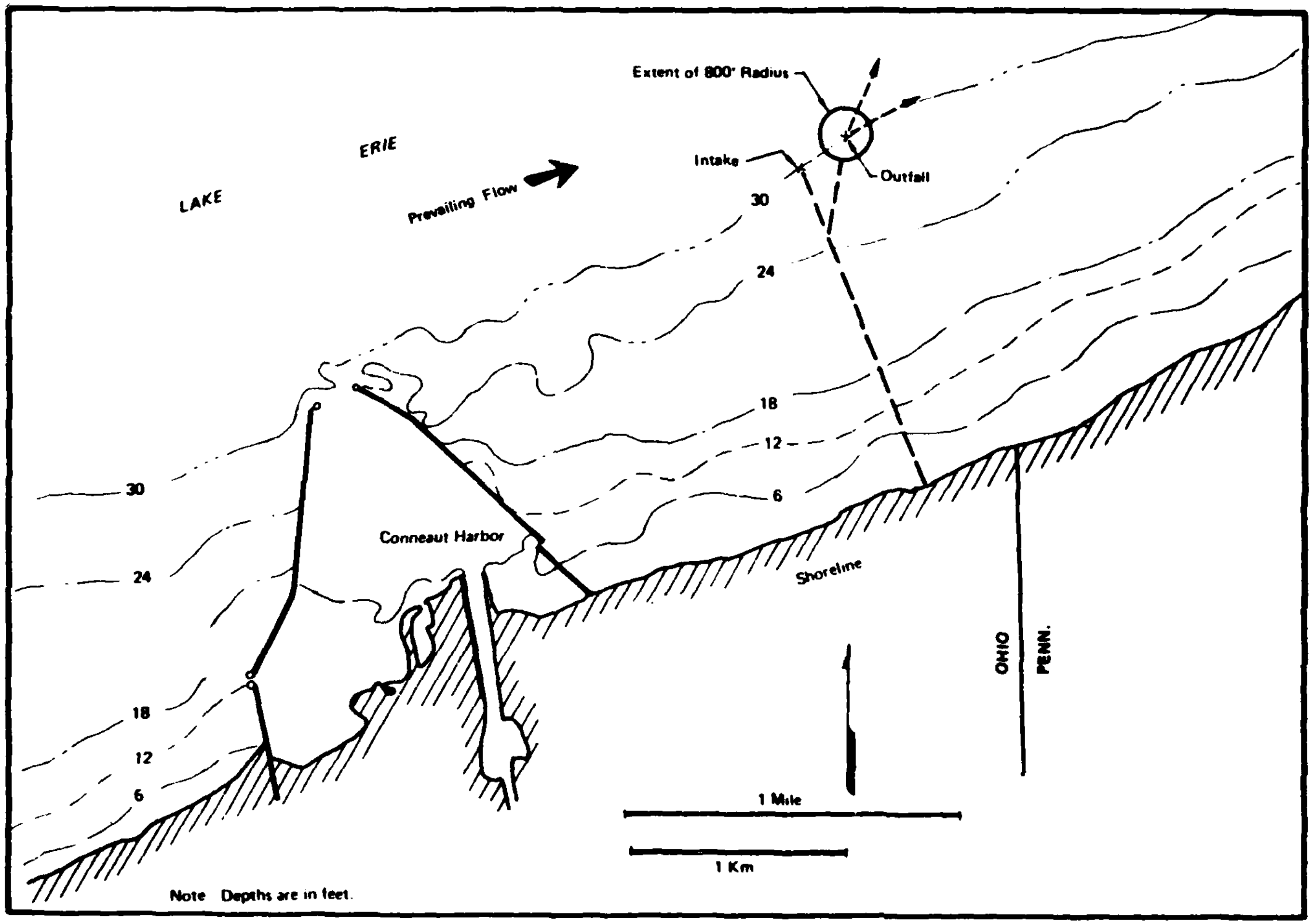
Projected Characteristics of the Proposed Discharge

Contaminants	Lake Erie Ambient Levels[1] Typical Case (mg/l)	High Case (mg/l)	Combined Effluent Levels Typical Case (mg/l)	Worst Case (mg/l)	800' Levels From 10 m Deep Outfall Typical Case (mg/l)	Worst Case (mg/l)	Ohio Proposed Ambient Std. (May 1977) (mg/l)	EPA Recommended Water Quality Criteria (mg/l)	IJC Recommended Ambient Standard (mg/l)
Ammonia (Total)	0.04	0.3 (0.2 max in summer)	0.96	3.1	.073	.46	0.025 un-ionized	0.02 un-ionized	
Arsenic (Total)	0.001	0.005	0.0030	0.0097	0.001	0.005	0.050	0.050 (PWS)[4]	0.05
Cadmium (Total)	0.001	0.005	0.0014	0.0066	0.001	0.005	0.0012	0.002 salmonids 0.0012 hard water for other fish	0.0002
Chlorine (Residual)	0.01[2]	0.01[2]	0.001-0.002	0.001					
Chromium (Total)	0.005	0.010	0.025	0.064	0.006	0.013	0.050	0.050 (PWS) 0.100 (aq. life)	0.05
Copper (Total)	0.001	0.005	0.0014	0.0066	0.002	0.005	0.005	1.0 (PWS) (0.1 x 96th LC_{50})	
Cyanide (Total)	0.0004	0.0008	0.13	0.38	0.005	0.023			
Cyanide (A)	0.0002	0.0005	0.017	0.052	0.0008	0.004	0.005	0.005	1.2
Fluoride (Dissolved)	0.11	0.20	1.6	4.7	0.18	0.46	1.8 (PWS)		1.2
Iron (Dissolved)	0.05	0.1	0.73	1.9	0.07	0.2	1.0 Total	1.0 Total	0.025
Lead (Total)	0.005	0.01	0.044	0.082	0.006	0.014	0.02	0.05 (PWS) 0.01 x 96h LC_{50}	
Manganese (Total)	0.01	0.02	0.20	0.37	0.017	0.04	0.05 (PWS)	0.05 (PWS)	0.0002
Mercury (Total)	0.0001	0.0002	0.00014	0.0004	0.0001	0.0002	0.00002 Max 0.00005 Ave	0.00005	
Oil & Grease	1.0	5.0	2.6	10.8	1.1	5.3	5.0	0.001 x 96h LC_{50}	
Phenols (Grouped)	0.0006	0.003	0.034	0.10	0.0018	0.009	0.001	0.001 (tainting)	
Chlorophenols[3]			0.001	0.005					
Sulfide (Total)	0.002	0.010	0.027	0.087	0.003	0.015		0.002	
TDS	200.0	250.0	590.0	860.0	210.0	290.0	200.0	250.0	200.0
TSS	10.0	20.0	19.0	40.0	10.0			10% above seasonal norm	
Zinc	0.020	0.070	0.031	0.10	0.02	0.07	0.03	5.0 (PWS) 0.01 x 96h LC_{50}	0.03
PH (Standard Units)	7.8	8.3 (7.0 low)	7.3	8.3 (6.0 low)					

(1) Available intake water, based on field measurements.
(2) Assumed negligible, based on field measurements.
(3) These are part of Phenol's measurement. They are listed separately for reference.
(4) PWS = Public Water Supply.

Note: U.S. Steel has recently indicated that three general types of chemical additives are expected to be used in the indirect cooling water system, and that it did not expect these to significantly affect water quality in the proposed discharge. The potential concentrations or effects of these additives are not discussed in this report.

Source: Various Lake Erie field measurements (ambient), NPDES permit data and EPA Effluent Guidelines for Iron and Steel Manufacturing, and estimates by United States Steel Corporation and Arthur D. Little, Inc.



Source: Arthur D. Little, Inc., from USGS Maps.

FIGURE 4–109 SCHEMATIC OF APPROXIMATE EXTENT OF 800-FOOT ISOPLETH AT 10-METER DEPTH

- The "worst" case effluent concentrations assumed maximum values of parameters from the plant and high lake concentrations in intake water.

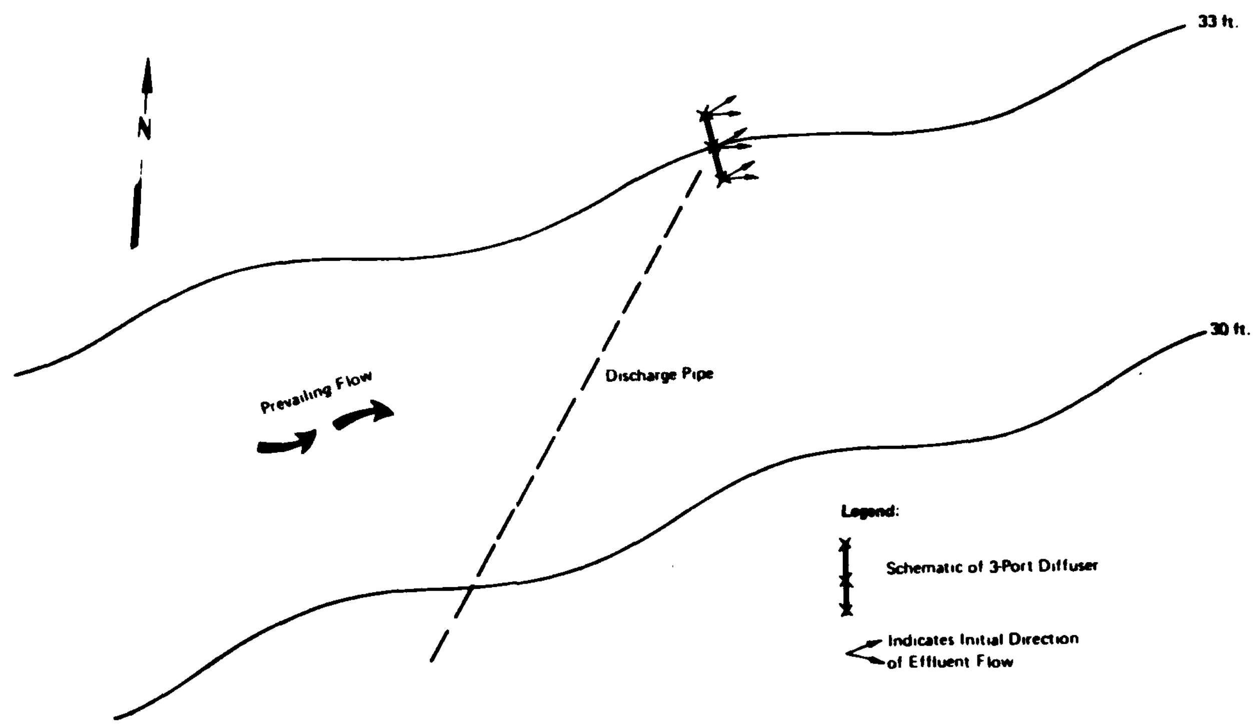
- Calculation of typical parameter concentrations including temperature in lake receiving waters are based on "typical" or "median" values of dilution potential (e.g., including air temperature and lake currents), ambient parameter concentrations and effluent parameter concentrations.

- The worst case conditions represent the simultaneous occurrence of various events including high ambient concentrations in Lake Erie, high loading from the proposed plant. The applicant's consultant has estimated that the simultaneous occurrence of all these "worst case" events would happen no more than once per year, so that these high or "worst" concentrations would have a recurrence interval of one year or longer.

4.895
Most of the toxicological data utilized in this section deal with the effects of a single contaminant under a set of circumstances, frequently dissimilar to Lake Erie. Thus, the data serve to indicate only the type of effects that might be anticipated. Furthermore, the assumption has been made, for purposes of "worst case" consideration, that concentrations of any parameter listed for the effluent or plume are of the chemical species that is toxic. This is both a simplification and a presumably conservative assumption, as the effects of absorption onto particulates and chemical combinations in the effluent cannot be quantified or evaluated without actual discharge monitoring. In addition, the decision by U. S. Steel to provide final retention ponds with 24-hour holding capacity would be expected to mitigate many of the "worst case" impact potentials discussed herein.

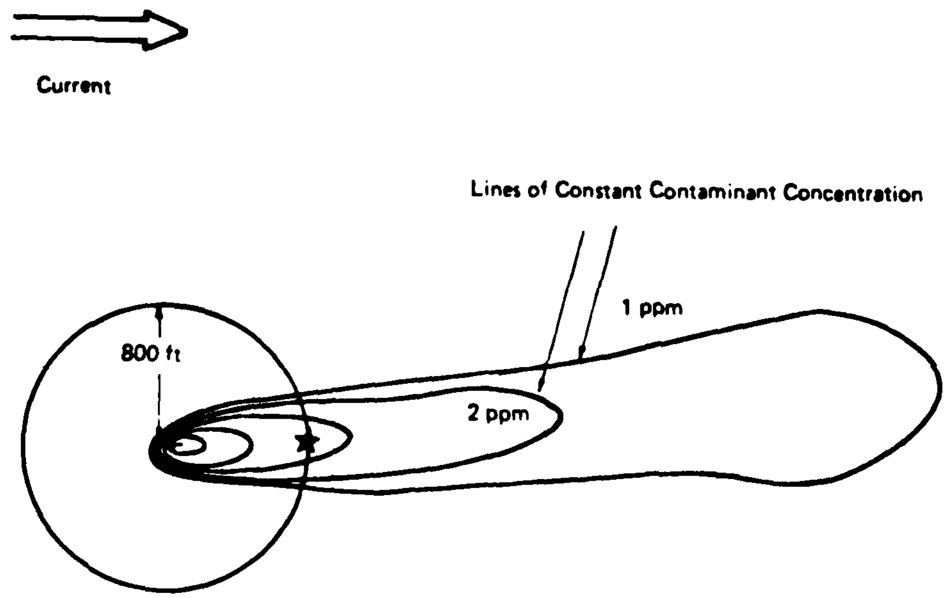
Temperature

4.896
The effluent discharge design, including three diffuser ports, would direct the flow of the effluent from the 10-meter depth toward the lake surface so that the center line of the resultant plume reaches the surface between 40 and 60 meters from the port (see Figures 4-110 and 4-111). "Slices" through this plume at three depths during worst case conditions for temperature and current speed in the spring are presented in Figures 4-112 through 4-114 (also refer to Table 4-350). The applicant's consultant considers the effluent temperatures, as



Source: Arthur D. Little, Inc.

FIGURE 4–110 SCHEMATIC OF SUBMERGED LAKE OUTFALL AT 10-METER DEPTH

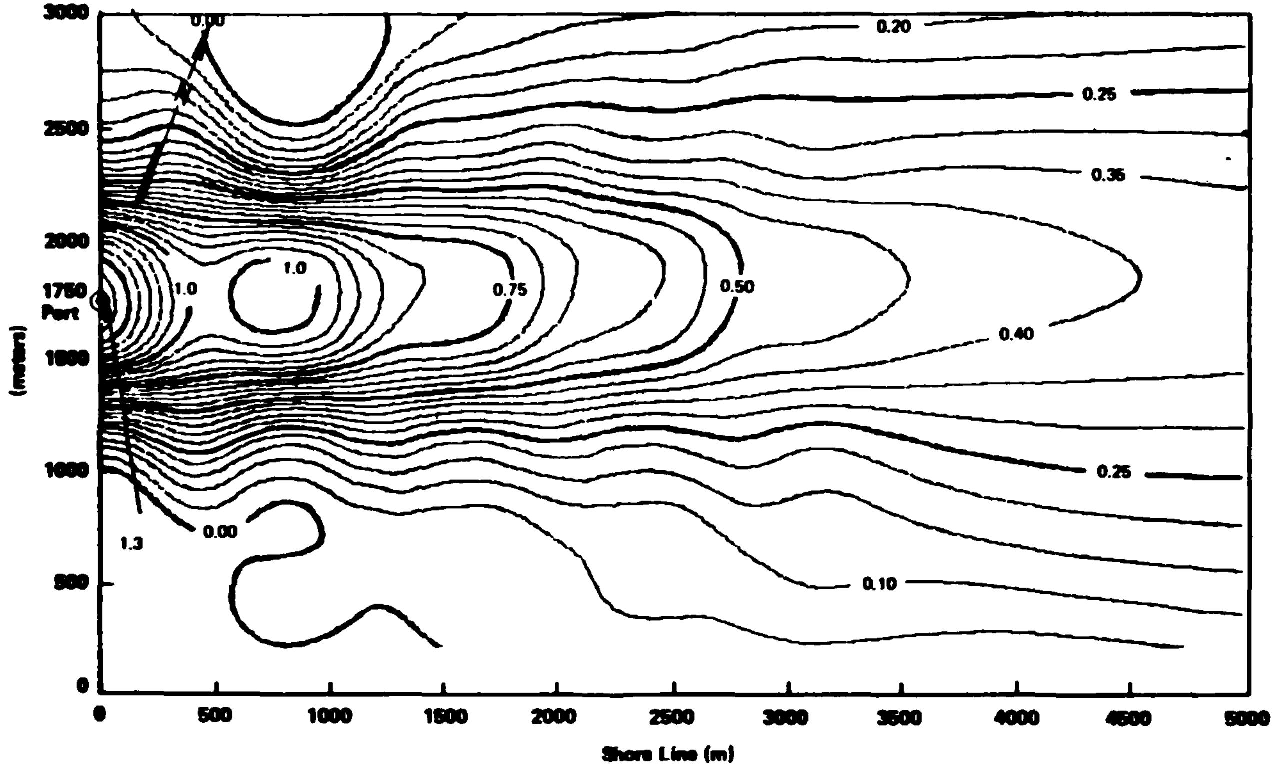


+ Outfall Location

★ Concentration Reference Point

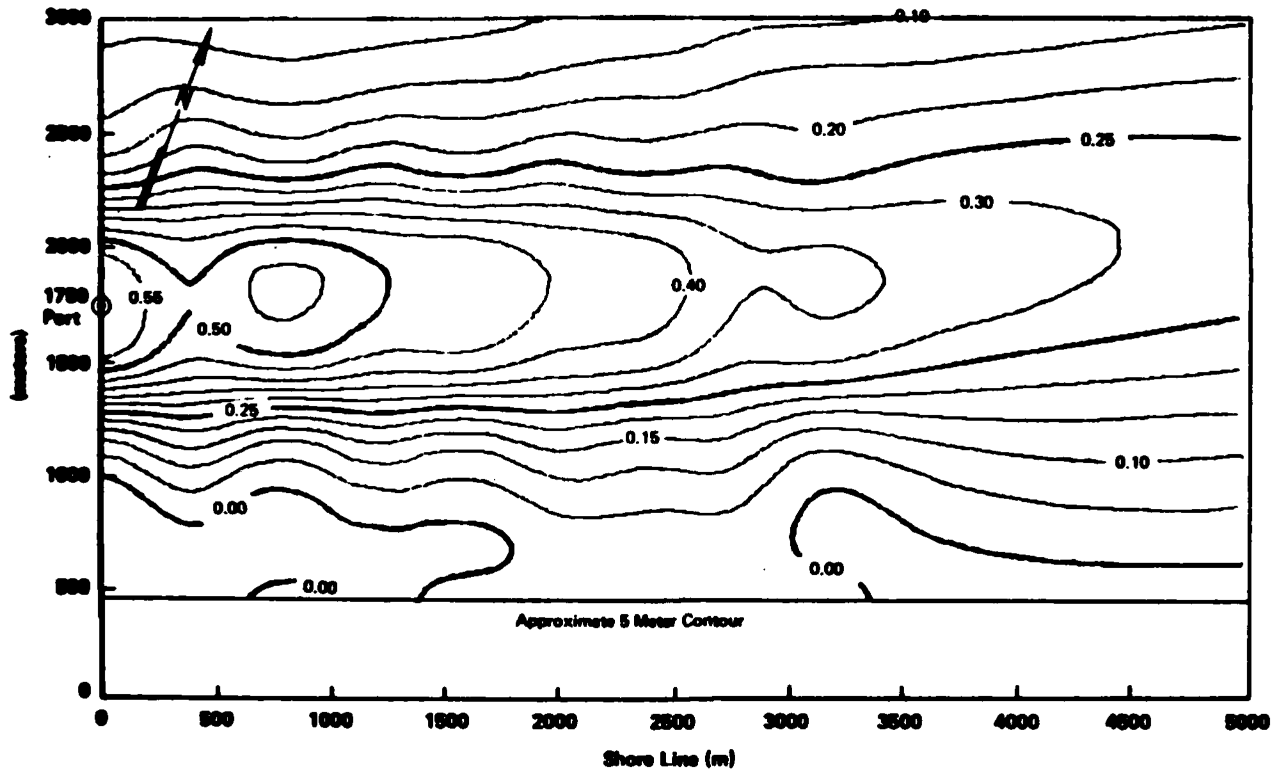
Note: The location marked with ★ is the reference point for all concentrations listed in tables in the Water Quality Impact section of this chapter. At all other points 800 ft. from the outfall the concentration will be less than indicated in those tables and the text.

FIGURE 4–111 SCHEMATIC OF EFFLUENT PLUME



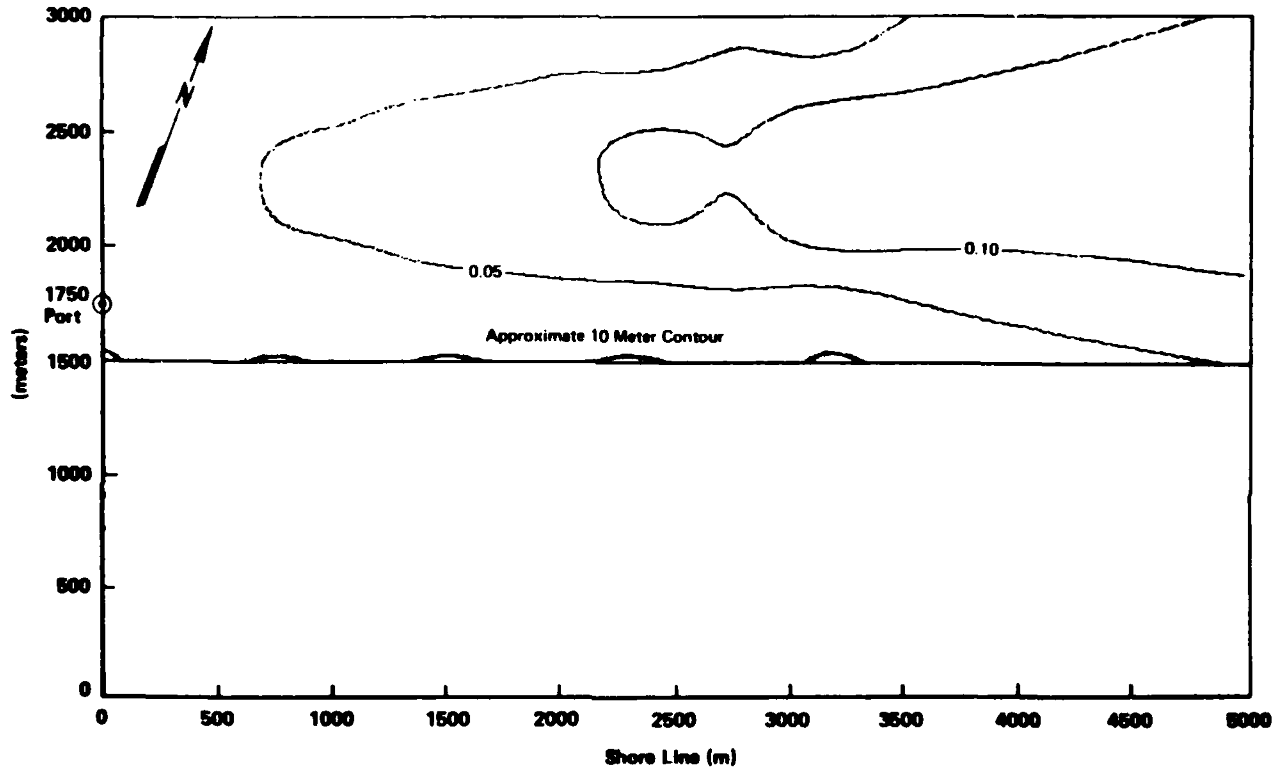
Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4–112 JUNE WORST CASE NO. 3–1 FOR TEMPERATURE (IN ^{o}C) – SURFACE
(See Table 4–339)



Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4–113 JUNE WORST CASE NO. 3–1 FOR TEMPERATURE (IN °C)– 5 METERS BELOW SURFACE



Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4–114 JUNE WORST CASE NO. 3–1 FOR TEMPERATURE (IN °C) — 10 METERS BELOW SURFACE

Table 4-350

Environmental Characteristics of Cases Studied by Computer Modeling of Proposed Lakefront Plant Outfall

Case	Case #	Month	Ambient Lake Temperature (°C)	Flowrate Thousand (gpm)	Depth (Meters)	Distance Offshore (Meters)	Effluent Temperature (°C)	Ambient Lake Current Speed (cm/sec)
Worst Case	(1-1)	Feb	0.6	45	10	1,750	21.1	1.5
Warm Day	(-2)							30.0
	(2-1)	Feb					9.0	1.5
Typical	(-2)							30.0
	(3-1)	Jun	13.3-13.6	45	10	1,750	32.6	1.5
Worst Case	(-2)							45.0
	(4-1)	Jun					25.3	1.5
Typical	(-2)							45.0
	(5-1)	Aug	24.3	45	10	1,750	32.3	1.5
Worst Case	(-2)							45.0
	(6-1)	Aug					27.3	1.5
Typical	(-2)							45.0
	(7-1)	Oct	14.1	45	10	1,750	30.6	1.5
Worst Case	(-2)							45.0
	(8-1)	Oct					22.2	1.5
Typical	(-2)							45.0

presented in Table 4-350, to be accurate within a range of about ±2°C. In general, high effluent temperatures combined with little or no current may be considered the worst case during any season, as relatively less mixing and heat dispersion occur than at higher current speeds and/or more typical effluent temperatures. In analyzing impacts of predicted temperature increments to Lake Erie biota, several types of thresholds have been reviewed:

- "Short exposure" maximum temperatures that will not cause mortality of important sensitive species.
- Maximum weekly average temperature that will not cause mortality if plume temperatures drop to ambient temperatures in colder months.
- Maximum weekly average temperatures that do not excessively exceed optimal temperatures for sensitive species in the area during warmer months; and
- Maximum weekly average temperatures that do not hinder reproductive function (4-96).

4.897
In examining the first criterion, specific maximum temperatures that might occur as the result of temperature inputs from the proposed facility were reviewed. Salmonids, white sucker (<u>castostomus commersoni</u>), yellow perch (<u>Perca flavescens</u>) and several <u>Notropis</u> species (forage) have relatively lower resistance to high levels of temperature than other species likely to occur in the region of the effluents (refer to Tables 4-351 and 4-352). The model of plant effluent plume temperature characteristics was examined for the area of water (at either surface or bottom) that might have temperatures in excess of maxima for these species. These are summarized in Table 4-353. Very little of the water in the plume is predicted to be at these temperatures in the relevant seasons. Thus, these results indicate that salmonids would be protected in the spring and fall, and all other species during these months and the summer months as well. Salmonids were not collected in numbers at the corresponding depths during the summer of 1977. The next concern was whether or not plume temperatures during winter months would be sufficiently high to result in mortalities of fishes if these fishes were exposed to "cold shock" as a result of plant shutdown or migrations out of the plume area. The former is considered unlikely, as plant shutdown would be gradual, possibly taking as long as two weeks. Although effluent temperature might be as high as 21.1°C under worst case conditions, predicted areas within the plume where temperatures

Table 4- 351

Upper and Lower Lethal Threshold Temperatures for Some Lake Erie Fishes

Species	Stage/Age and Test Location	Extreme	Acclimation Temperature (C°)	Incipient Lethal Temp. (or Lethal Threshold) (C°)
Catostomus commersonni (white sucker)	Adult Don River, Ontario, Canada	Upper	5	26.3
			10	27.7
			15	29.3
			20	29.3
			25	29.3
		Lower	20	2.5
			25	6.0
Dorosoma cepedianum (gizzard shad)	Under Yearling Put-In-Bay, Ontario, Canada	Upper	25	34.0
			30	36.0
			35	36.5
		Lower	25	10.8
			30	14.5
			35	20.0
Esox lucius (northern pike)	Juvenile Maple, Ontario, Canada	Upper	25	32.5
			27.5	32.75
			30	33.25
Esox masquinongy (muskellunge)	Juvenile Hatchery, Ontario, Canada	Upper	25.0	32.25
			27.5	32.75
			30.0	33.25
Ictalurus nebulosus (brown bullhead)	*Florida to Ontario,* combined	*Upper*	5	27.8
			10	29.0
			15	31.0
			20	32.5
			25	33.8
			30	34.8
			34	34.8
		Lower	20	0.5
			25	4.0
			30	6.8
Ictalurus punctatus (channel catfish)	Juvenile Cantaton, Arkansas Hatchery	Upper	26	36.6
			30	37.8
			34	38.0
	Adult Waleka, Florida and Put-In-Bay, Ohio	Upper	15	30.4
			20	32.8
			25	33.5
		Lower	15	0
			20	0
			25	0
Lepomis macrochirus (bluegill)	Adult Waleka, Florida	Upper	15	30.5
			20	32.0
			25	33.0
			30	33.8
		Lower	15	2.5
			20	5.0
			25	7.5
			30	11.0
Micropterus salmoides (large mouth bass)	Under Yearling Put-In-Bay, Ohio	Upper	20	32.5
			25	34.5
			30	36.4
		Lower	20	5.5
			30	11.8

Table 4-351 (Continued)

Species	Stage/Age and Test Location	Extreme	Acclimation Temperature (C°)	Incipient Lethal Temp. (or Lethal Threshold) (C°)
Notropis alterinoides	Juvenile	Upper	5	23.3
(emerald shiner)	Welland, Ontario,		10	26.7
			15	28.9
			20	30.7
			25	30.7
		Lower	15	1.6
			20	5.2
			25	8.0
Notropis cornatus	Adult	Upper	5	26.7
(common shiner)	Ontario		10	28.6
			15	30.3
			20	31.0
			25	31.0
		Lower	20	3.7
			25	7.8
Oncorhynchus kisutch	Juvenile	Upper	5	22.9
(coho salmon)	Fresh Water		10	23.7
	Hatchery, B.C.		15	24.3
			20	25.0
			23	25.0
		Lower	5	0.2
			10	1.7
			15	3.5
			20	4.5
			23	6.4
Oncorhynchus tsahwytscha	Juvenile	Upper	10	24.5
(chinook salmon)	Combined data Oregon		10	22.9
	and Washington		10	24.5
			11	23.0
				23.5
				23.8
			20	23.8
				24.7
				24.8
			4	20.0
				13.5
Perca flavescens	Adult	Upper	5	21.3
(yellow perch)	Lake Simco, Ontario		11	25.0
			15	27.7
			25	29.7
		Lower	25	3.7
Salmo gairdnerii	Juvenile	Upper	18	26.5
(rainbow trout)	Britain			
Salmo trutta	30 days after hatch	Upper	5	22.2
(brown trout)	Hatchery, England		10	23.4
			20	23.5

Source: Adapted from Quality Criteria for Water, USEPA, 1976; Biological Aspects of Thermal Pollution, P.A. Krenkel and F.L. Parker, eds. Vanderbilt University Press, 1969; and Temperature and Aquatic Life, Laboratory 6, Technical Advisory and Investigation Branch, Technical Services Program, Federal Water Pollution Control Administration, U.S. Department of the Interior, December 1967.

Table 4- 352

Upper and Lower Lethal Temperatures for Some Lake Erie Benthos

Species	Acclimation Temperature (°C)	Test Temperature (°C)	Effect
Oligochaeta			
Limnodrilus		6	No Reproduction
hoffmeisteri		30	Not injurious to any life stage
Amphipoda			
Hyalella azteca	10-20	34	Estimated highest 24-hour LC50 that could be attained by raising acclimation temperature
Ephemeroptera			
Stenonema sp	-	30	Greatest abundance
	-	32-40	Rarely observed
Chironomidae			
Cryptochironomus	-	2.5	Mean lower limit
		36.5	Mean upper limit
Trichoptera			
Hydropsyche sp		23.5-30	Greatest numbers observed
		34	96 hr TLM
		34+	Numbers reduced

Source: Data supplied by Aquatic Ecology Associates.

Table 4- 353

Temperatures and Speed in the Effluent Plume at Various Distances from Diffuser Ports

Case	Radial Distance From Diffuser (m)	Speed (m/sec) Centerline	Speed (m/sec) Bottom	ΔTemp. °C Centerline	ΔTemp. °C Bottom	Ambient Temp °C
Winter: High Effluent Temperature	5	2.9	2.9	12.3	12.3	0.6
	10	1.3	1.3	5.5	5.5	0.6
	15	.94	.93	4.0	4.0	0.6
	20	.67	.63	2.8	2.7	0.6
	25	.56	.50	2.4	2.2	0.6
	30	.45	.35	1.9	1.6	0.6
	35	.39	.26	1.7	1.2	0.6
	40	.33	.16	1.4	.8	0.6
	45	.30	.11	1.3	.6	0.6
	50(1)	.26	.05	1.1	.3	0.6
Winter: Typical Effluent Temperature	5	2.9	2.9	5.1	5.1	0.6
	10	1.3	1.3	2.2	2.2	0.6
	15	.94	.94	1.6	1.6	0.6
	20	.67	.67	1.2	1.2	0.6
	25	.56	.56	1.0	1.0	0.6
	30	.45	.45	.8	.8	0.6
	35	.40	.40	.7	.7	0.6
	40	.34	.34	.6	.6	0.6
	45	.31	.31	.5	.5	0.6
	50(1)	.27	.27	.5	.5	0.6
	55	.25	.25	.4	.4	0.6
Spring: High Effluent Temperature	5	2.0	2.0	8.1	8.0	13.3-13.6
	10	1.3	1.2	5.1	4.9	13.3-13.6
	15	.93	.80	3.7	3.3	13.3-13.6
	20	.73	.51	2.9	2.2	13.3-13.6
	25	.50	.13	2.0	.7	13.3-13.6
	30	.42	.05	1.7	.3	13.3-13.6
	35(1)	.38	.03	1.5	.2	13.3-13.6
Spring: Typical Effluent Temperature	5	2.0	2.0	5.1	5.1	13.3-13.6
	10	1.3	1.3	3.2	3.2	13.3-13.6
	15	.93	[illegible]	2.3	2.3	13.3-13.6
	20	.73	.70	1.8	1.7	13.3-13.6
	25(1)	.51	.44	1.3	1.2	13.3-13.6
Summer: High Effluent Temperature	5	2.9	2.9	5.4	5.4	24.3
	10	1.3	1.3	2.4	2.4	24.3
	15	.93	.90	1.7	1.7	24.3
	20	.66	.57	1.2	1.1	24.3
	25	.55	.42	1.0	.8	24.3
	30	.44	.23	.8	.5	24.3
	35	.39	.14	.7	.3	24.3
	40	.33	.06	.6	.1	24.3
	45(1)	.29	.02	.5	.1	24.3
Summer Typical Effluent Temperature	5	2.9	2.9	1.8	1.8	24.3
	10	1.3	1.3	.8	.8	24.3
	15	.94	.93	.6	.6	24.3
	20	.67	.63	.4	.4	24.3
	25	.56	.50	.3	.3	24.3
	30	.45	.35	.3	.2	24.3
	35	.39	.26	.2	.1	24.3
	40	.33	.16	.2	.1	24.3
	45	.30	.11	.2	.1	24.3
	50(1)	.26	.05	.2	.1	24.3

Table 4-353 (Continued)

Case	Radial Distance From Diffuser (m)	Speed (m/sec) Centerline	Speed (m/sec) Bottom	Δ Temp. °C Centerline	Δ Temp. °C Bottom	Ambient Temp °C
Fall: High Effluent Temperature	5	2.9	2.9	9.9	9.9	14.1
	10	1.3	1.3	4.4	4.3	14.1
	15	.93	.84	3.2	3.0	14.1
	20	.66	.46	2.2	2.2	14.1
	25	.55	.28	1.9	1.1	14.1
	30	.43	.09	1.5	.4	14.1
	35 (1)	.38	.04	1.3	.2	14.1
Fall: Typical Effluent Temperature	5	2.9	2.9	4.9	4.9	14.1
	10	1.3	1.3	2.2	2.2	14.1
	15	.94	.93	1.6	1.6	14.1
	20	.67	.65	1.1	1.1	14.1
	25	.56	.53	.9	.9	14.1
	30	.45	.39	.8	.7	14.1
	35	.40	.32	.7	.6	14.1
	40	.34	.23	.6	.4	14.1
	45	.30	.17	.5	.3	14.1
	50	.27	.11	.4	.2	14.1
	55 (1)	.24	.07	.4	.2	14.1

(1) Last radial distance figure in each case is the point at which water is predicted to hit the surface.

Source: Arthur D. Little, Inc. estimates.

10°C and above might be experienced by fishes were small or non-existent (refer to Table 4-353). Predicted temperatures in the centerline of the plume (the warmest part) drop below 10°C within less than 10 meters of the ports in the worst case, and never reach such temperatures under typical conditions as shown in Table 4-354.

4.898
Relatively fewer data are available for analysis of possible "cold shock" to fish acclimated to elevated winter plume temperatures. Furthermore, most of the information is concerned with elevated plume temperatures of 15°C can suffer "cold shock" mortalities at 1.7°C. These elevated temperatures are not expected for effluent under typical conditions and are predicted to cover a very small area under worst case conditions. Gizzard shad (Dorosoma cepedianum) have frequently been observed wintering in heated effluents. Data on lower lethal limits of heat-acclimated fish of this species are available only for acclimation temperatures of 25°C and higher. Some of these indicate that this species may be more susceptible to cold shock than coho salmon (refer to Table 4-351); but other recent work in the Regional Study Area suggests that the gizzard shad is relatively tolerant of cold shock (4-97). Although shad would be expected in the effluent plume, temperatures even 5°C above ambient are predicted for a very small area under typical conditions, based on estimates illustrated in Table 4-354.

4.899
Although the temperature differentials in the discharge are significant, they must be put in perspective with residence time and area enclosed by the plume. The monthly average discharge temperature and temperature differentials over ambient indicate that during extreme winter conditions a decrease from an elevated temperature to ambient could be damaging to sensitive species of fish. However, the portion of the plume at these elevated temperatures is extremely small, reaching less than 3°C above ambient within 20 meters of the discharge structure under worst case winter conditions. Within 35 meters from the structure the plume temperature declines to 1.7°C or 3°F above ambient. The discharge velocity of 13 to 16 feet per second would prevent residence and acclimation of adult fishes at the highest temperature areas. The portion of the plume in which fish are likely to reside in any abundance has a temperature differential in the range of 2°C or less above ambient. No significant impact due to cold shock is anticipated.

4.900
Spring is an important time of year in terms of spawning and growth of young finfish and benthos. Elevated temperatures of a few degrees can lead to advanced spawning and/or hatching of a variety of species in the spring. This can be detrimental if the timing is ahead of

Table 4- 354

Estimates of Temperatures Within the Effluent Plume During Different Seasons

Description	Depth (meters)	Season	Conditions	Area (m^2)/ Distance (meters)
I. Plume Centerline Distance to Temp.				
24°C	0;10	Winter	Worst Case Typical Case	None[(1)]
24°C	0;10	Spring	Worst Case Typical Case	None
24°C	0;10	Fall	Worst Case Typical Case	None
29°C	0;10	Summer	Worst Case Typical Case	None
20°C	0;10	Winter	Worst Case Typical Case	None
15°C	0;10	Winter	Worst Case Typical Case	None
10°C	0;10	Winter	Worst Case Typical Case	None
II. ΔT				
1.0°C and higher	10	Spring	Worst Case	A = 67.7 m^2
1.0°C and higher	5	Spring	Worst Case	A = 43.2 m^2
0.5°C and higher	10	Spring	Worst Case	A = 109.94 m^2
0.5°C and higher	5	Spring	Worst Case	A - 116.54 m^2
1.0°C and higher	10	Spring	Typical Case	A = 67.10 m^2
1.0°C and higher	5	Spring	Typical Case	None*
0.5°C and higher	10	Spring	Typical Case	A = 108.60 m^2
0.5°C and higher	5	Spring	Typical Case	None*

Table 4-351 (Continued)

Description	Depth (meters)	Season	Conditions	Area (m^2)/ Distance (meters)
II. ΔT				
$1.0^{o}C$ and higher	10	Fall	Worst Case	A = 67.08 m^2
$1.0^{o}C$ and higher	5	Fall	Worst Case	A = 32.34 m^2
$0.5^{o}C$ and higher	10	Fall	Worst Case	A = 114.30 m^2
$0.5^{o}C$ and higher	5	Fall	Worst Case	A = 99.84 m^2
$1.0^{o}C$ and higher	10	Fall	Typical Case	A = 38.76 m^2
$1.0^{o}C$ and higher	5	Fall	Typical Case	None
$0.5^{o}C$ and higher	10	Fall	Typical Case	A = 124.46 m^2
$0.5^{o}C$ and higher	5	Fall	Typical Case	A = 4.04 m^2

(1) The term "None" is misleading as the model could not resolve areas within a 6.5 meter distance from the port.

Source: Arthur D. Little, Inc. estimates.

normal spring increases in food supply for young or if large mid-spring fluctuations in temperature subsequently occur. There are optimal temperatures for growth of juveniles and young (refer to Table 4-355). Nakatani (4-98) described increases in young chinook salmon mortality with temperature increments exceeding 4°F (about 2.2°C). At several depths the area of the plume with a predicted 1°C or greater increment in temperature were calculated from model approximations. Table 4-354 lists these areas for typical and worst case conditions. The fall calculations were also added because of fall migrations of salmonids. This series of calculations indicates that volumes of water where increases greater than 2 or 3°C in temperature might be experienced by fishes are predicted to be quite small (note: one acre = 4,047 m^2).

4.901
Several studies have examined fish attraction to heated effluents. Neill and Magnuson (4-99) found that yellow perch, mottled sculpin, subadult yellow bass, and subadult black bullhead regularly avoided the heated effluents of a power plant with a shoreline discharge. Longnose gar, adult carp, yellow bass, young rock bass, young pumpkinseed, bluegill, and largemouth bass were at least occasionally concentrated in the outfall area relative to control areas. Some of these associations may reflect a combination of depth and heat effects. Coutant (4-100) commented that fish may congregate in warmer areas during cool months or during rapid ambient temperature declines. Abrupt thermal gradients of greater than 4 to 5°C may repel most fishes, as acclimation to temperature takes time. When increments are experienced gradually, fish may congregate at their "temperature preferendum." Based on a summary of field observations of such temperatures in this report, alewife, goldfish, white sucker, carp, gizzard shad muskellunge, channel catfish, bluegill, smallmouth bass, largemouth bass, yellow perch, walleye, and rainbow trout are all examples of species that could be attracted to the predicted effluent temperatures, at least in cooler months. Spignarelli (4-101) reported that fish did not congregate in the thermal plume of a Lake Michigan nuclear power plant discharge between July and October (compared to control areas). Early spring densities were often not above those of control areas; sampling was not done during winter months. Maximum densities of fish in the plume were observed in the intermediate temperatures, rather than high ones. However, during spawning seasons, anadromous species were attracted to the immediate discharge area (highest fall or spring discharge temperature observed as 21.5°C). This may have been due to temperature, flow volume, or both. By using temperature sensitive tags on salmonids, Spignarelli observed that these fishes did not spend much time in contact with high temperatures, but were attracted to thermal discharges in their shoreline migration.

Table 4- 355

Summary Temperature Effects Data on Selected Lake Erie Fishes

[Maximum weekly average temperature for spawning; short term maxima for embryo survival during spawning season; calculated maximum weekly average temperatures for growth and short-term maxima for survival of juveniles and adults during the summer.](1)

Species	Spawning (°C)	Embryo Survival (°C)	Growth (°C)	Juvenile and Adult Survival (°C)
Bluegill	25	34	32	35
Channel Catfish	27	29	32	35
Coho Salmon(2)	10	13	18	24
Emerald Shiner	24	28	30	-
Freshwater Drum	21	26	-	-
Largemouth Bass	21	27	32	34
Northern Pike(2)	11	19	28	30
Rainbow Trout(2)	-	-	19	24
Smallmouth Bass	17	-	29	-
White Sucker(2)	10	20	28	-
Yellow Perch	12	20	29	-

(1) Adapted from summary tables in Quality Criteria for Water, United States Environmental Protection Agency, 1976, pp. 433, 434.

(2) Northern pike, coho salmon, rainbow trout, and white suckers are known to make runs up nearby tributaries during spawning periods and have not been shown to spawn in the Lake. However, white sucker larvae and juvenile salmonids (possibly stocked) have been collected in the littoral zone near the project site (the latter in the spring). The remainder of listed species are near-shore Lake Erie spawners in the spring.

4.902
In summary, temperature impacts associated with the proposed facility may attract fishes to the plume. Impacts on spawning or survival of juveniles are not predicted to be significant. A winter shutdown would be gradual and would be unlikely to cause mortality in expected sensitive winter residents like the gizzard shad. Effects of the heated effluent in the nearfield on benthos populations would probably be masked by the scouring effect created by the proposed discharge's high velocity. The scouring of the bottom by currents is evident under baseline conditions. Benthos in the region of the proposed discharge are typically those that can exist in little or no substrate (e.g., bivalves between rock crevices and boulders). An area in the immediate vicinity of the discharge is not expected to support a diverse or extensive benthic fauna. This high effluent velocity along the bottom decreases rapidly with distance, as do temperature increments (refer to Table 4-354). The impact of the proposed plant effluent on total benthic biomass in this area of Lake Erie is expected to be small.

4.903
Increases in temperature are known to affect species composition in algae and zooplankton communities. The volume of water containing $1^{o}C$ increments or greater is predicted to be quite small. Measureable shifts in populations of algae or invertebrates are not expected in this region of Lake Erie, although the possibility exists for some changes in the immediate vicinity of the diffusion ports. The potential for a great increase in phytoplankton production for a period of time sufficient to cause nuisance levels is eliminated by the extremely short exposure to elevated temperatures. However, a slight increase in productivity could result if adequate nutrients are available. The rapid change in temperature to which plume-entrained zooplankton are exposed could cause a lethal effect, even if maximum lethal temperatures are not exceeded. Plume induced turbulence and plume-induced vertical movements could cause disorientation and disruption of locomotory and feeding behavior of zooplankton. This may result in increased predation on zooplankton and lowered zooplankton feeding in the area. The thermal plume could cause depression of populations during the warmer months of the year and increased populations during the colder months. Any effects on zooplankton are expected to be highly localized.

Inorganic Contaminants

4.904
Ammonia. When ammonia dissolves in water, an equilibrium is established which contains free, un-ionized ammonia, and both ammonium ions and hydroxide ions. It is the former chemical species that is largely or totally responsible for ammonia toxicity (4-96). The

percent of un-ionized ammonia varies with temperature and pH. Increases in one or both of these parameters increase the percent of un-ionized ammonia (refer to Table 4-356). Thus, a concentration of 3.4 mg/l total ammonia at 10°C and a pH of 7.5 will contain 0.020 mg/l of ammonia; while only 0.36 mg/l total ammonia at a pH of 8.5 and a temperature of 10°C is required to contain the same 0.020 mg/l un-ionized ammonia of USEPA recommended limit (4-96). Effluent concentrations of total ammonia have been projected at 0.96 mg/l (3.1 mg/l for the worst case). As discussed below, short-term lethal concentrations have been reported for concentrations as low as 0.2 mg/l un-ionized ammonia. At the elevated temperatures expected in the undiluted effluent, under typical operating conditions, the above-mentioned lethal concentrations of un-ionized ammonia for sensitive salmonids would not be reached. With a "worst case" situation, such lethal concentrations would be reached if the pH of the effluent were over 8.2 with temperature above 26.5°C (lower for higher pH) and the ambient pH were also above 8.2 (4-102). Sampling to date shows the ambient pH off the proposed site to be less than 8.2 in all measurements from spring through summer, 1977. Modeling of dispersion in the associated plume indicates that high temperatures would be rapidly reduced within a short distance of the port. Even with very high effluent temperatures, predicted temperatures are reduced to 1°C above the ambient at the centerline or warmest portion of the plume within 50 meters (see Table 4-354). If this occurs, fish would have to remain in the higher velocity portions of this stream, very near the port, to have a chance of being affected under this worst case situation. There is some limited evidence that fish exhibit avoidance reactions to lethal, but not sublethal concentrations of ammonia (4-193).

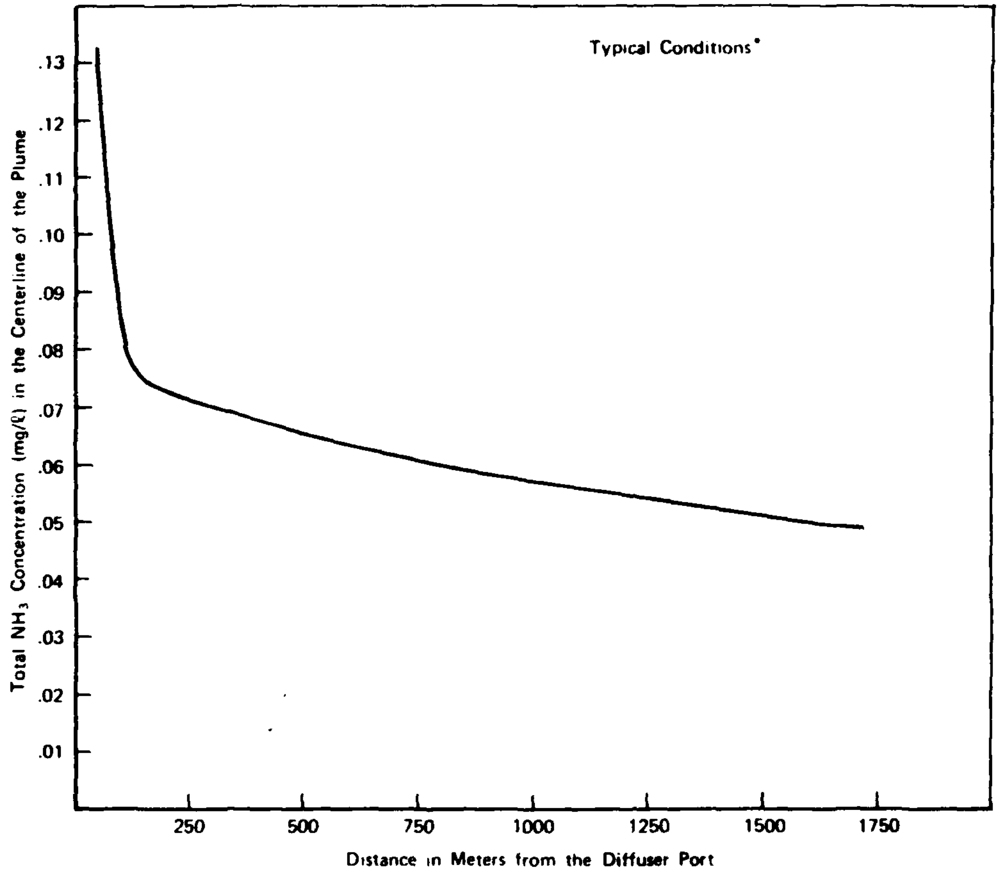
4.905
Figures 4-115 through 4-117 illustrate predicted total ammonia concentrations in the centerline of the plume. This is the point where concentrations in the plume would be highest at any given distance from the port (see Figure 4-111). Under typical lake ambient and effluent concentrations, spring and fall levels below 0.02 mg/l un-ionized ammonia are predicted much closer than 50 meters from the port. A concentration of 0.0036 mg/l un-ionized ammonia was calculated at 50 meters assuming a temperature of 15°C and a pH of 8.0 (which is slightly high). Increasing the temperature to 25°C increases the concentration of un-ionized ammonia to 0.007 mg/l at 50 meters. With winter temperatures of 5°C and a conservative pH of 8.0, concentrations at 30 meters from the port are predicted to be 0.0015 mg/l un-ionized ammonia. These low levels would be expected to offset increases in toxicity reported (below) for extremely low temperatures. Sublethal effects on salmonids have been observed after six to 12 months in concentrations in the 0.006 mg/l un-ionized ammonia range. However, salmonids are not expected to spend

Table 4- 356

Percent Un-Ionized Ammonia in Aqueous Ammonia Solution

	pH Value		
Temp. °C	7.5	8.0	8.5
5	0.39	1.2	3.8
10	0.59	1.8	5.6
15	0.86	2.7	8.0
20	1.2	3.8	11.0
25	1.8	5.4	15.0
30	2.5	7.5	20.0

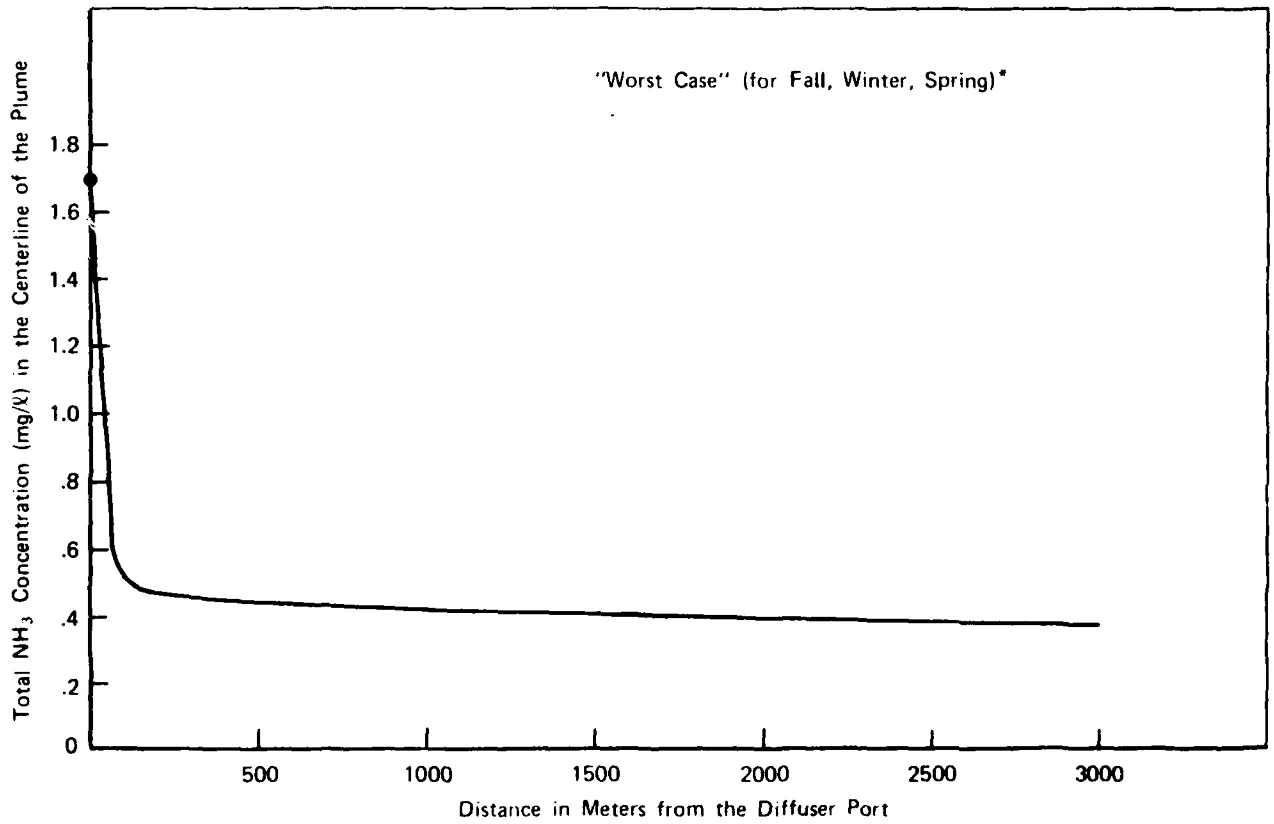
Source: Adapted from Quality Criteria for Water, United States Environmental Protection Agency, Washington, D.C., July, 1976.



*Ambient Concentration: 0.04mg/ℓ
Effluent Concentration: 0.96mg/ℓ

Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

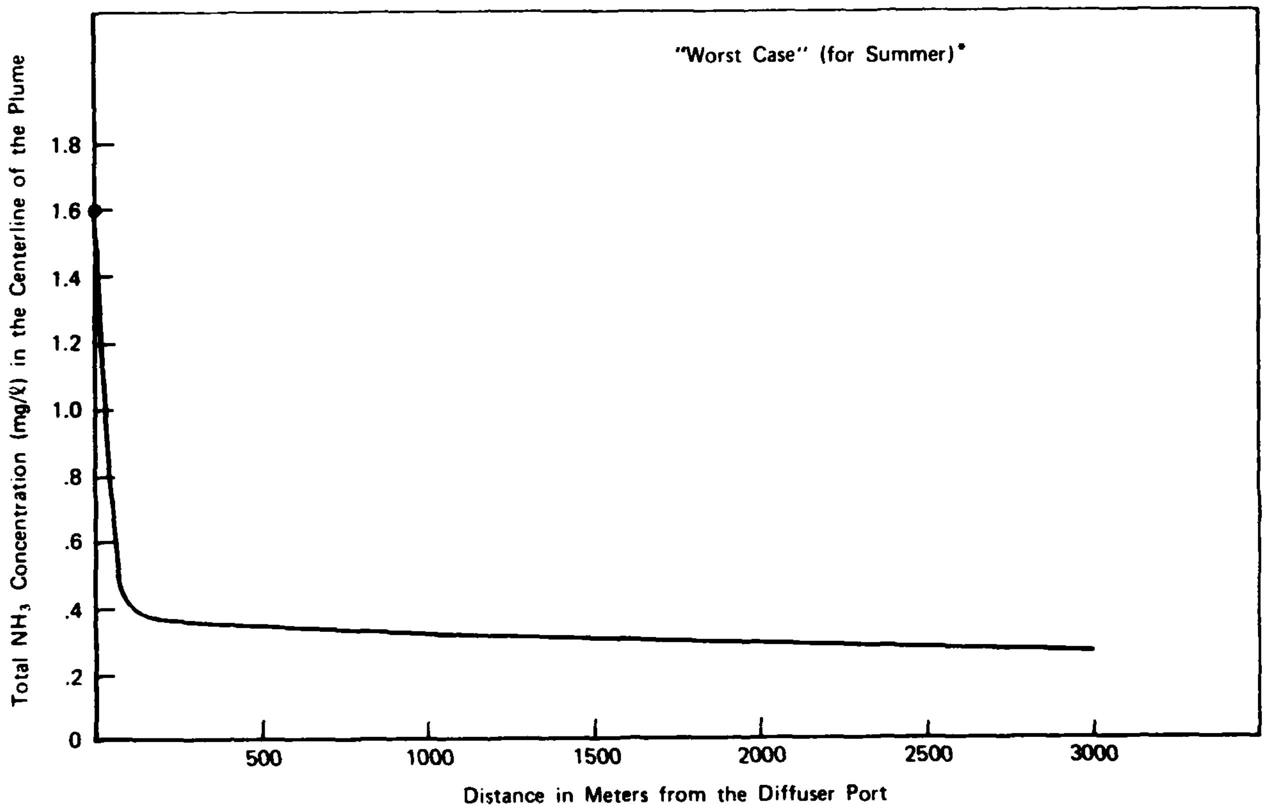
FIGURE 4–115 **TOTAL AMMONIA CONCENTRATIONS IN THE PLUME CENTERLINE WITH DISTANCE FROM THE PORT**



*Ambient Concentration: 0.3mg/ℓ
Effluent Concentration: 3.1mg/ℓ

Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text).

FIGURE 4–116 TOTAL AMMONIA CONCENTRATIONS IN THE PLUME CENTERLINE WITH DISTANCE FROM THE PORT



*Ambient Concentration: 0.2mg/ℓ
Effluent Concentration: 3.0mg/ℓ

Source: Lake Plume Model based on Arthur D. Little, Inc., and United States Steel Corporation estimates (see text)

FIGURE 4–117 TOTAL AMMONIA CONCENTRATIONS IN THE PLUME CENTERLINE WITH DISTANCE FROM THE PORT

this amount of time in the effluent. Furthermore, they have not been collected in the proposed area of the outfall in the summer when these levels would be observed. Volumes of water containing threshold effects levels of ammonia during other times of the year would be extremely small. Under worst case conditions for spring and fall, concentrations of approximately 0.023 mg/l un-ionized ammonia are predicted in the centerline of the plume at 50 meters from the port. (Assuming pH of 8.0 and a temperature of 15°C.) In the winter, the levels of un-ionized ammonia would be lower, at the same total concentration, but toxicity increases below 5°C (see below). Worst case conditions are predicted to be of short duration and are not expected to produce sublethal effects. Ambient levels of 0.3 mg/l total ammonia would be reached about 2,000 meters from the port in the centerline, according to the modeling results. The potential for lethal effects at the port itself are of somewhat greater concern.

4.906
Under worst case conditions in summer months, when ambient Lake Erie levels rarely reach 0.2 mg/l total ammonia, predicted concentrations in excess of the sublethal effects level of 0.02 mg/l un-ionized ammonia are reached within the modeled plume at least 500 meters from the port (in the plume centerline assuming a temperature of 25 and pH of 8.0). Although the assumed summer Lake Erie background levels of 0.2 mg/l total ammonia are conservatively high and worst case discharge conditions are predicted to be of very short duration, if no mitigative measures were implemented, this volume of water is predicted to contain un-ionized ammonia levels considered unsafe. As indicated previously, pH threshold of 8.2, required at these temperatures to produce these effects, has not been recorded in summer 1977 sampling off the site. Results of acute toxicity tests conducted on fresh water aquatic biota, indicated that the salmonid fishes are among the most sensitive species upon short-term (equal to or less than) exposure to un-ionized ammonia contamination (4-103, 104, 105). Median lethal concentrations reported trout (<u>Salmo gairdnerii</u>) range from 0.2 mg/l un-ionized ammonia to around 0.5 mg/l un-ionized ammonia. Similar short-term studies indicate LC_{50}s of at least an order of magnitude greater for bluegill sunfish (<u>Lepomis macrochirus</u>) and creek chub (<u>Semotilus atromaculatus</u>) (4-106). Ball (1967) found that four species of cyprinid were as susceptible as rainbow trout, but that they could survive longer before these concentrations became lethal.

4.907
Sublethal concentrations of ammonia have been shown to cause a range of effects on fishes, including hyperplasia of gill epithelium, liver changes and effects on blood and excretion levels (4-196). The observations of several investigators are listed in Table 4-357.

Table 4-[illegible]7

Reported Effects of Chronic Exposure to Ammonia(1)

Species	Chronic Dose	Sublethal Effect	Literature Citation
Rainbow Trout (Juveniles)	1.60 ppm ammonia (0.0166 ppm un-ionized)	4 months: mild to moderate scattered fusion of gill lamellae. 6-12 months: more severe fusion of gill lamellae; changes in liver splenic and intestinal tissue; growth reduction; increased susceptibility to bacterial gill disease.	Smith and Piper [4-197]
Rainbow Trout (Juveniles)	0.59-1.20 ppm ammonia (0.0061-0.0125 ppm un-ionized)	9-12 months: mild gill hyperplasia	Smith and Piper [4-198]
Chinook Salmon (Fingerlings)	0.3 ppm ammonia (Un-ionized concentrations disputed)	6 weeks - gill hyperplasia and reduced growth	Burrows [in 4-198, 4-187]

(1)Notes: (from Table 4-327)

Ohio proposed ambient standard: 0.0025 un-ionized ammonia.
Typical spring and fall projected concentrations at 50 meters (~165 ft) from Lakefront Plant outfall: 0.0036 mg/1 un-ionized ammonia.
Typical summer projected concentrations 50 meters (~165 ft) from outfall: 0.007 mg/1
Typical winter projected concentrations 50 meters (~165 ft) from outfall: 0.0015 mg/1.

Effects on juvenile rainbow trout exposed to 1.60 ppm ammonia (0.0166 ppm un-ion-ized) at 10 and a pH of 7.75 in the laboratory, became increasingly severe and obvious when fish were left at these concentrations for six, nine, and 12 months. Mild gill hyperplasia was also observed in a few fishes in ammonia concentrations of 0.59-1.20 ppm (0.0061-0.0125 ppm un-ionized) after nine and 12 months. Fish kept at 1.6 ppm total ammonia for nine and one-half months and returned to control water for 45 days had essentially normal tissues. Fish at these higher concentrations for long periods of time also appeared to be much more susceptible to bacterial gill disease. Burrows Oin 4-196o reported similar effects on fingerling chinook salmon held in even lower concentrations of ammonia for only six weeks (0.3 mg/l and 0.7 mg/l total ammonia). These calculations of un-ionized ammonia have subsequently been disputed (4-102, 107). The work of other investigators did not find effects at these low levels (4-96, 107, 108)

4.908
Lloyd and Orr (4-108) demonstrated increased diuresis in rainbow trout exposed to concentrations of un-ionized ammonia that ranged from 0.09 to 0.45 ppm (mg/l) in the laboratory. They suggested that ammonia caused an increase in permeability of the fish to water and that death would follow an inability to offset this increased permeability. They also showed that rainbow trout can acclimate, to some extent, to sublethal levels of ammonia, possibly because of increase rates of detoxification of the ammonia. This acclimation was not retained after an interval of three days. Some evidence indicates that un-ionized ammonia is more toxic below 10^{o}C and that at 3^{o}C, threshold toxic concentrations are about half those at 10^{o}C, sufficient to offset the effect of lower temperature on the dissociation of ammonia. (4-103, 108) While the European Inland Fisheries Advisory Commission adopted a 0.025 mg/l un-ionized ammonia criteria, they suggested that confidence in this as a safe level below 10^{o}C has not been established, and that the criterion should not be applied to temperatures below 5^{o}C or to pH values above 8.5.

4.909
Hydrogen Sulfide (H_2S). Hydrogen sulfide (H_2S) is a soluble gas. Its dissociation in water, a pH dependent reaction, produces the less toxic sulfide ion. Above pH 9, almost all hydrogen sulfide is ionized, while below pH of 5, almost none is. At a pH of 7.0 (near values expected from effluent) approximately 50 percent of the dissolved hydrogen sulfide remains as hydrogen sulfide, while at a pH of 7.8 (typical of Lake Erie ambient levels) only 30 percent remains as the more toxic hydrogen sulfide. Anaerobic decomposition of organic material in the aquatic system itself can produce hydrogen sulfide. Furthermore, hydrogen sulfide is not a conservative toxicant: oxidation to sulfate, volatilization of hydrogen sulfide,

and precipitation with metals, all remove hydrogen sulfide from solution.

4.910
Estimated typical concentrations of un-ionized hydrogen sulfide are approximately 0.137 mg/l (50 percent of 0.27 mg/l) at pH levels predicted for the effluent. Of the individuals that would find such concentrations lethal, in a short-term exposure, rainbow trout fry and northern pike fry would not be expected in the area of the effluent pipe, although the presence of the former is a possibility. Walleye spawning (and hence, fry) was not revealed by sampling this area during 1977. It is highly unlikely that this stage of young fish could get near the pipe where such concentrations are predicted, because of high effluent velocity. Under worst case modeled effluent conditions, levels of hydrogen sulfide of approximately 0.043 (50 percent of 0.087) are at or near short-term lethal concentrations of all of the juveniles mentioned above, as well as adult bluegills. There is some evidence that fishes avoid toxid H_2S concentrations. (4-96) However, with the higher temperatures in the effluent near the pipe, any long exposure with concentrations near these upper levels could cause juvenile fish mortalities. Hydrogen sulfide, which is non-conservative, should be rapidly diluted with distance from the port. At a distance of 800 feet from the port, projected levels are still above ambient lake levels when one considers dilution only. As hydrogen sulfide is not conservative, it is likely that these predicted levels are substantially higher than would be observed. Under typical conditions, assuming an ambient pH of 7.8, hydrogen sulfide levels would be below the lowest chronic effects level of 0.001 mg/l for bluegill reproduction. Even predicted worst condition levels are below chronic levels for most species tested. It should be noted that Lake Erie ambient levels are typically above the Smith, et al. (4-109) recommended "no effects" level of 0.001 mg/l hydrogen sulfide for areas utilized for reproduction by nesting fish. The proposed discharge location does not appear to be such an area, based upon the 1977 sampling results. Under worst conditions, background ambient lake levels may also approach lethal effects levels report for many juveniles. Such effects were not noted during the lake sampling effort in 1977.

4.911
Toxic effects levels in the aquatic ecosystem vary with wide-ranging natural tolerances of species, ambient temperature, season, life stage, and in some cases, acclimation. Effects levels even vary with the origin of the population. This range of possible effects makes prediction of toxic levels of hydrogen sulfide on untested species difficult. (4-109) Smith and Oseid (4-94) found fry of rainbow trout, walleye, white sucker, and northern pike to be the most sensitive life stage of each species. Reduced oxygen levels increased

sensitivity. Walleye fry and juveniles were the most sensitive tested in this situation, while rainbow trout fry were slightly less sensitive. However, white sucker eggs hatchability was lowest and the percent of deformed fry highest at concentrations of hydrogen sulfide 0.023 mg/l. Adelman and Smith (4-110) suggest a maximum possible safe level for northern pike fry at 0.004 to 0.006 ppm hydrogen sulfide for 96 hours of exposure. Smith, et al. (4-109) looked at acute and chronic toxicity of hydrogen sulfide to seven fish species and eight species of invertebrates (at pH of 7.5 and water hardness at 220 mg/l as $CaCO_3$). Mean tolerance units (LC_{50}) reported for species tested included hose shown in Table 4-358. The cyprinids (minnows) appeared to have greater tolerance, for short periods of time, to higher concentrations of hydrogen sulfide and low temperatures. Bluegills and fathead minnows exhibited some acclimation to hydrogen sulfide when initial exposures were in the sublethal range. In chronic tests, levels as low as 0.001 mg/l for 97 days affected reproduction in bluegills and 0.007 mg/l for 90 days reduced survival and growth of rainbow trout fry. Exposure to this latter concentration for 225 days reduced survival of Walleye juveniles.

4.912
There was a wider range of tolerance among the invertebrates tested. LC_{50} of 1.46 mg/l hydrogen sulfide for Asellus to 0.028 mg/l for Baetis (under test conditions appropriate to the species). Those typically found where anoxic conditions occur (e.g., Asellus militaris, Cragonyx richmondensis laurentiamis) were more tolerant that those which,inhabit cold, well aerated flowing water (e.g., Gammarus pseudolimnaeus and Baetis vagans). The burrowing benthos (Hexagena and Ephemera) were also slightly more tolerant than the cold water, substrate surface dwellers. In chronic tests, levels above 0.0013 mg/l hydrogen sulfide for over 100 days caused reduced numbers of Gammarus while concentrations of 0.0129 to 0.0152 for 138 days did not have a significant effect on emergency or nymphal survival for Hexagena.

4.913
Mercury. Measurements of total mercury can include metallic mercury, mercuric ion, mercurous ion and organic species including methyl mercuric ion and dimethyl mercury. The latter two forms have been shown to be among the most toxic to aquatic species as well as man. (4-96) The detection limit for total mercury in Lake Erie water as estimated in the 1977 sampling program is 0.5 ug/l. This is an order of magnitude above limits for long-term average concentrations set by Ohio. Background Lake Erie ambient levels for total mercury have been estimated at 0.1 to 0.3 ug/l (refer to Table 4-359) or above the standard even under typical conditions. Predicted additions of mercury by proposed plant operations would be negligible relative to

Table 4- 353

Mean H_2S Tolerance Units For Tested Species[1]

Rainbow Trout	Sac Fry	0.0077 mg/l (20 days, 13°C)
	Juveniles	0.0121 mg/l (17 days, 13°C)
Walleye	Sac Fry	0.0096 mg/l (4 days, 15°C)
	Juveniles	0.0282 mg/l (4 days, 15°C)
White Sucker	Sac Fry	0.0287 mg/l (4 days, 15°C)
	Juveniles	0.033 mg/l (4 days, 15°C)
Northern Pike	Sac Fry	0.036 mg/l (4 days, 13°C)
Bluegill	Sac Fry	0.0253 mg/l (9 days, 22°C)
	Juveniles	0.0481 mg/l (8-10 days, 20°C)
Goldfish	Eggs	0.321 mg/l (4 days, 22°C)
	Juveniles	0.1201 mg/l (4 days, 20°C)
Fathead Minnow	Sac Fry	0.0093 mg/l (6 days, 24°C)
	Juveniles	0.0182 mg/l (8-10 days, 22°C)

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(1) These are all present in Lake Erie. However, suckers, Cyprinid species, Notropis species, Centrarchid species, and the Percids were the most common in the region of the outfall. Thus, data on the fathead minnow, goldfish, bluegill, and walleye from the above list are the most directly applicable. Young trout may be present, but have not been recorded in collections to date at these depths.

Source: "The Effects of Hydrogen Sulfide on Fish and Invertebrates, Part 1 -- Acute and Chronic Toxicity Studies," Lloyd L. Smith, et al., United States Environmental Protection Agency, Office of Research and Development, Duluth, Minnesota, July 1976.

Table 4- [illegible]

Effects Reported for Acute and Chronic Exposure to Methyl Mercury Compounds

Species	Dose (μg/l)	Effect	Literature Citation
Salmo gairdneri (newly hatched rainbow trout sac fry)	24	96-hr LC_{50}	Wobeser, 1973 [in 4-187]
Salmo gairdneri (fingerlings)	42	96-hr LC_{50}	Woebeser, 1973 [in 4-187]
Salmo gairdneri (fingerlings)	30	LC_{50}	Matida, 1971 [in 4-187]
Salvelinus fontinalis (brook trout)	0.93 (for 24 months for offspring of parental generation exposed to this dose)	Reduced growth altered behavioral symptoms no spawning 94% mortality	McKim, *et al.* [in 4-187]
Pimephales promelas (fathead minnow)	0.29 0.23 (for 3 months) 0.12 (for 3 months) 0.07	No effects death no spawning no effect	Mount, 1974 [in 4-187]
Daphnia magna (invertebrate)	0.04	Reproductive impairment	Biesing, 1974 [in 4-187]

Notes: (from Table 4-327)
Ohio proposed ambient standard: 0.05 μg/l maximum, total mercury
Typical Lake Erie concentration: 0.1 μg/l, total mercury
Typical levels projected for Lakefront Plant effluent: 0.14 μg/l total mercury
Typical levels projected for 800 from Lakefront Plant diffuser: 0.1 μg/l total mercury

background levels. The applicant has indicated they expect no net additional of mercury by the proposed plant. Concentration of ambient levels of all parameters, including mercury, is expected in the effluent due to the evaporative loss of intake waters by cooling towers. Dilution would allow lake levels of mercury to be attained quickly under both typical and worst case predicted conditions.

4.914
The levels of mercury that exist under baseline conditions, and presumably will continue to exist during plant operation, are high enough to cause fish bioaccumulation above Food and Drug Administration (FDA) safe levels assuming the 10,000 concentration factor. Pillary, et al. (4-111) reported mercury content of edible tissues (prepared from composites of 8-25 fishes of each species collected in 1970) of walleye, white bass, freshwater drum, coho salmon, white sucker, and smallmouth bass exceeded this level. It is quite possible that the 0.5 ug/l level will continue to be exceeded in some fishes as long as lake levels of total mercury (hence methyl mercury) remain high.

4.915
Acute toxicity levels for young salmonids were reported at levels that range from 24 mg/l to 42 mg/l (refer to Table 4-359). Altered behavior, reduced spawning and mortality are among the effects reported for chronic exposure to concentrations of methyl mercury below 1 ug/l, with the invertebrate, Daphnia magna appearing to be the most sensitive. The "no effects" levels reported for fishes ranged from 0.23 ug/l to 0.07 ug/l. The majority of mercury entering the aquatic environment will ultimately become associated with the bottom sediments where, exposed to microbial action, dimethylmercury and methylmercuric ions can be formed. (4-112) Similarly, methyl mercury may also be demethylated by bacterial action. (4-96, 113) Thus, toxic forms of mercury can be converted to the more toxic forms (and vice versa). In recommending standard levels of mercury for fresh water the EPA and International Joint Commission (IJC) based the 0.05 ug/l total mercury on evidence that relatively small amounts of this total would be present as methyl mercury. Fish preferentially and rapidly bioaccumulate methyl mercury and excrete this form at extremely slow rates. Based on what are considered safe levels of methyl mercury consumption for humans, a 0.5 ug/l level of mercury in edible portions of fish has been established by the U.S. Food and Drug Administration and its Canadian counterpart. This level assumes a 10,000-fold concentration factor for waters at 0.05 ug/l total mercury. However, higher concentration factors have been reported but with methylmercuric ion as the major form added to the aquatic environment. (4-967)

4.916

Copper. Copper in small amounts is an essential element for many plant and animal species. The toxicity of this element to aquatic life is due primarily to the cupric ion in solution and the hardness of the water in which it occurs. (4-114) This ion is complexed by anions present in solution so that water of higher alkalinity generally reduces copper toxicity. Furthermore, organic material such as natural detritus or domestic sewage can also lower copper toxicity due to complexes formed. (4-114, 115) The EPA recommends that copper levels in drinking water not exceed 1 ug/l because of the possibility of undesirable taste. Predicted levels of copper, in the effluent, do not reach this concentration. No net addition of copper is expected to be added by the proposed plant, relative to existing background concentrations. As noted in the section of this chapter on water quality impacts, concentration of ambient levels of all parameters including copper, is expected in the effluent due to the evaporative loss of intake waters by cooling towers.

4.917

The results of acute and chronic exposure to copper are reported in Table 4-360. In general, concentrations between 0.17-0.89 mg/l were acutely toxic to fishes tested, although bluegills appeared to be even less sensitive. In most cases, invertebrates tested for copper toxicity appeared to have a higher degree of tolerance. However, Cladocerans appear to be more sensitive to copper in soft water than fishes tested under similar conditions. Anderson (4-114) conducted studies in Lake Erie water and listed effects including immobilization, at concentrations as low as 0.012 mg/l copper. Similarly, while copper sulfate has been used to control algal growth, lethal and noninhibiting concentrations for groups such as Mougeotia, Cladophora, and others in soft water are above lethal concentrations for fishes under similar conditions. In controlled experimental ecosystems (a lab-type study) algae and zooplankton species ominants changed with low copper concentrations (10-50 mg/liter). (4-95) However, these studies were conducted with marine species and are not directly applicable to fresh water field situations. The variations in copper sensitivity of many species make such results quite possible. In an examination of chronic copper toxicity to a number of species in hard water, (187 mg/l as calcium carbonate) brook trout, eggs and fry were observed to be more sensitive than channel catfish or walleye eggs. Sublethal effects were observed at concentrations 0.008 mg/l for these trout populations (see Table 4-338). Lorz and McPherson (4-116) found that as coho salmon (Oncorhynchus kitsutch) matured into smolts in the spring their sensitivity to copper increased, compared to levels the previous fall. These levels are all higher than levels of copper predicted for the effluent.

Table 4- 3?0

Effects Reported for Acute and Chronic Exposure to Copper Compounds

Species	Conditions	Dose (mg/l)	Effect	Literature Citation
Salmo gairdneri (rainbow trout juveniles)	200 mg/l alkalinity 290 mg/l hardness	0.89	96-hr LC_{50}	Calmari [in 4-187]
Salmo gairdneri	200 mg/l alkalinity 320 mg/l hardness	0.4-0.5	48-hr LC_{50}	Brown [in 4-187]
Oncorhynchus tshawytscha (chinook salmon)	80 mg/l hardness	0.178	96-hr LC_{50}	Holland [in 4-187]
Lepomis macrochirus (bluegills)	300 mg/l alkalinity 300 mg/l hardness	10.2	96-hr LC_{50}	Pikering [in 4-187]
Pimephales promelas (fathead minnow)	90-230 mg/l alkalinity 120-336 mg/l hardness	0.56-0.99	96-hr LC_{50}	Brungs, *et al.* [in 4-187]
Ictalurus nebulosus (brown bullhead)	156 mg/l alkalinity 200 mg/l hardness	0.18	96-hr LC_{50}	Brungs [in 4-187]
Pimephalas notatus (bluntnose minnow)	154 mg/l alkalinity 200 mg/l hardness	0.29	96-hr LC_{50}	NWQH [in 4-187]
Oncorhynchus kisutch (coho salmon)	68-78 mg/l alkalinity	0.074 0.060	96-hr LC_{50} for fall juveniles 96-hr LC_{50} for spring smolts	Lorz & Mcpherson [in 4-207]
Cladocerans (invertebrates)	44-53 mg/l hardness	0.005-0.0098	LC_{50}	[in 4-208]
Ephemerella (invertebrate mayfly)	44 mg/l hardness	0.32	48-hr TLM	Warnick & Bell [in 4-209]
Salvelinus fontinalis (brook trout eggs and fry)	187 mg/l hardness	0.074 0.049 (for 30 days)	batch reduced survival and growth reduced	Sauter, *et al.* [in 4-210]
		>0.008 (for 60 days) 0.005 (for 60 days)	length and weight reduced no effect	
Salvelinus fontinalis (brook trout)	soft water	0.0174-0.325	survival, growth and reproductive success reduced	McKim & Benoit [in 4-211]
		<0.0174	no effect	
Cladocerans (invertebrates)	Lake Erie water	0.012	immobilization	Anderson [in 4-205]

Notes (From Table 4-327)

Notes Ohio proposed ambient standard: 0.005 mg/l

Typical Lake Erie concentrations: 0.001 mg/l

Typical levels projected for Lakefront Plant effluent: 0.030 mg/l

Typical levels projected for the effluent plume 50 meters (165 ft) from the outfall: 0.005 mg/l

Typical levels projected for 250 meters (800 ft) from the outfall: 0.002 mg/l

4.918
Zinc. Zinc concentrations are high in Lake Erie. Using the EPA recommended safe limit of 0.01 X 96-hour LC_{50} for more sensitive species (i.e. salmonids) one could approximate that typical lake levels barely meet this requirement, and recorded high levels exceed it. (4-96) High lake concentrations also exceed the Ohio standards. Although the proposed plant would have slightly increased concentrations of zinc in its effluent, significant amounts of zinc are not expected to be added. Acutely toxic levels are not reached in the predicted effluent, although worst case concentrations approach chronic effect levels. Under typical conditions, relatively safe levels of zinc, based upon reported effects levels, are predicted in the effluent. Under worst case conditions, where these relatively safe levels are not met in the effluent, the major reason is the high ambient lake concentrations as opposed to the discharge contribution. Zinc toxicity, like that of copper, is reduced by increases in water hardness and alkalinity and increases in pH.

4.919
Both an increase in temperature and a decrease in dissolved oxygen increase the toxicity of zinc. (4-96) A maximum of 50 percent increase in zinc toxicity was observed with a decrease in dissolved oxygen from 6-7 mg/l to 2 mg/l. In rainbow trout concentrations that are acutely toxic to fishes induce cellular breakdown of the gills, possibly causing mucous clogging of the gills as well. Widespread histological changes to body organs along with general enfeeblement are reported due to chronic exposure to zinc. Specific study results are reviewed in Table 4-361. As with copper, the salmonid fishes and certain zooplankters such as the Cladocerans appear to be the most sensitive among species for which toxicity data exist. The 96-hour LC_{50} data for rainbow trout range from 1.95 mg/l in very soft water to 7.32 mg/l in very hard water. It is expected that such values for Lake Erie water would fall somewhere in between these two extremes.

4.920
Sensitivity to zinc may increase with size. Chinook salmon appear to have toxicity thresholds in the same range as rainbow trout. Zitko and Carson (4-117) found that the lowest incipient lethal concentrations of zinc for juvenile Atlantic salmon (Salmo salar) coincided with the initial spring parr-smolt transformation and could explain variations for increased size observed above by earlier experiments (see Table 4-361). This is similar to variations observed in salmonid sensitivity to copper. Hodson and Sprague (4-118) indicated that toxicity of zinc to fishes may increase in the winter months. They found that although river populations of Atlantic salmon (Salmo salar) survived longer at cooler temperatures, the threshold lethal concentration (LC_{50}) was lower. A 48-hour LC_{50} value for the invertebrates Daphnia magna in soft water is

Table 4- 361

Effects Reported for Acute and Chronic Exposure to Zinc Compounds[1]

Species	Conditions	Dose (mg/l)	Effect	Literature Citation
Salmo gairdneri (rainbow trout juveniles)	238 mg/l alkalinity 333 mg/l hardness	7.32	96-hr LC_{50}	Sinley, *et al.* [4-213]
Salmo gairdneri				
3.9 gram fish	10 mg/l hardness	2.40	96-hr TLM	Holcombe & Benoit [in 4-187]
28.4 gram fish	10 mg/l hardness	1.95	96-hr TLM	
Pimephales promelas (fathead minnow)	100 mg/l hardness pH of 8	8.1	96-hr TLM	Mount [in 4-187]
Daphnia magna (zooplankton)	42 mg/l alkalinity 45 mg/l hardness	0.100	48-hr LC_{50}	Biesinger & Christiansen [in 4-187]
Ephemerella subvaria (mayfly)	44 mg/l hardness	16	10-day LC_{50}	Warnick & Bell [4-209]
Salmo gairdnerii	330 mg/l hardness	∿0.320 (21 months)	no mortality; possibly reduced reproductive capacity	Sinlay, *et al.* [4-213]
Pimephales promelas	200 mg/l hardness	0.180	83% reduction in egg production	Brungs [in 4-187]
Cladophora glomerata (algae)	not reported	0.08-4.0	"just non-inhibitory"	Whitten [4-208]

[1] Notes: (from Table 4-327)
Ohio proposed ambient standard: 0.03 mg/l
Typical Lake Erie concentration: 0.02 mg/l
Typical levels projected for Lakefront Plant effluent: 0.031 mg/l
Typical levels projected for 250 meters (800 ft) from Lakefront Plant diffuser: 0.02 mg/l

somewhat lower than toxic levels observed for salmonid fishes in soft water. Thus, it would appear that these invertebrates are at least as sensitive as fish. Mayflies and stoneflies are among the invertebrates tested that are far less sensitive. (4-119, 120)

4.921
Relatively fewer studies have reported chronic effects of zinc. Sinley, et al. (4-121) exposed rainbow trout to a range of zinc concentrations in hard water 330 mg/l as $CaCO_3$. For up to 21 months, they did not obtain valid reproductive data, this species being a difficult one to use in lab reproductive experimental situations. Measured zinc levels at or below 0.320 mg/l did not cause mortality. No significant variation in growth rate was observed. Chronic tests in soft water also indicated increased tolerance when trout were exposed to zinc as eggs rather than as juveniles. Brungs and Jones (4-122) observed impaired egg production for fathead minnows in 0.180 mg/l zinc in water with hardness of 200 mg/l. He reported the maximum acceptable toxic concentration for this species 0.03-0.180 mg/l in water of this hardness.

4.922
Nehring (4-120) illustrated some zinc accumulation by two mayfly and stonefly species. However, concentrations used were above 0.60 mg/l and water hardness references were unclear (it appeared to be soft water). It is not possible to predict this effect due to concentrations in Lake Erie with these data.

4.923
Iron. In waters such as Lake Erie, with pH above 5 and containing dissolved oxygen essentially no dissolved ferrous or ferric iron would be expected. Dissolved iron species in the effluent of the proposed plant could include the iron cyanide complexes (discussed under cyanide), ferric chloride or ferric or ferrous sulfate. Ferric oxide would also be expected. Since this compound is insoluble, it would not be part of the dissolved iron measurements or approximations, but instead it would probably be included in the total suspended solids approximation. Modelled concentrations of dissolved iron in the effluent and at the 250-meter (800-ft) isopleth are well below reported effects levels. In the presence of other controlling factors (e.g. large changes in pH) insoluble ferric oxides can be converted to gels or flocs in water that can be detrimental to aquatic biota. If sufficient amounts are suspended in water, they can block the gills of fishes. They can also settle and blanket benthic invertebrates. The latter would not appear to be a large problem considering the general scouring effect of currents in this portion of Lake Erie. The potential for flocs in effluent water sufficient to have acutely toxic effects on fishes is thought to be minimal. Information on the toxicity of iron is sparse at best.

Some studies are reviewed in Table 4-362. A 96-hour LC_{50} value of 0.32 mg/l ferrous sulfate has been reported for mayflies. Pike (Esox lucius), and trout were reported to have died at iron concentrations of 1 to 2 mg/l. Unfortunately, the form of iron used in these experiments was not reported. In studies done with Gambusia affinis (not in Lake Erie) ferric chloride was shown to be approximately two to five times as toxic as either of the iron sulfates (48-hour LC of 74 mg/l) in turbid water. A 48-hour LC_{50} of 21 mg/l also using ferric chloride was reported for the invertebrate, Dephnia magna.

4.924
Cadmium. Cadmium is considered a biologically non-essential, non-beneficial element. Evidence exists indicating accumulation of cadmium with long-term exposure and increasing concentrations. However, bio-concentration along food chains has not been demonstrated. (4-96, 113) Predicted concentrations of cadmium, even in the effluent itself, are generally below the reported effects levels, as discussed below. However, the hardness of Lake Erie receiving water is somewhat lower than test values, so toxicity could be effective at slightly lower concentrations. The EPA Water Quality criteria for salmonids and was set at 0.0012 mg/l cadmium for hard water. (4-96) The Ohio standard for Lake Erie is the same as EPA's criterion. Making no distinction between hard and soft water environments, the International Joint Commission's recommended objective for all the Great Lakes is 0.0002 mg/l of cadmium. (4-96) Due to the observed cumulative effects of longer term exposure to cadmium, a 0.000001 mg/l maximum permissible concentration was suggested by Sauter, et al. (4-123) Approximations of typical Lake Erie levels exceed these latter figures and high ambient Lake levels exceed even the less stringent Ohio standard and EPA criteria. Cadmium, according to most investigations, appears to be somewhat less toxic in hard water than in soft, although relatively fewer studies have been conducted in hard water. Calcium carbonate hardness measured in Lake Erie off the proposed site indicated that water in this area ranges from "moderately hard" to "hard." (Measurements in Lake Erie by Pennsylvania Environmental Consultants in 1977 were usually in the 120-150 mg/l range.) Of freshwater species examined in lab studies, salmonid fishes, midge larvae and Cladocerans appear to be the most sensitive. As mentioned above, cadmium also appears to have a cumulative effect, increasing mortality with longer exposure times. (4-123,124,125). Lethal concentrations of cadmium reported for both hard and soft water test conditions are typically at least one order of magnitude greater than concentrations predicted for the effluent of the proposed plant. (4-96,113) Chronic tests with lower concentrations have more applicability (see Table 4-363). In water of approximately 200 mg/l hardness effects of chronic exposure, resulting in reduced survival and/or growth and reproduction, were

Table 4- 3[illegible]

Effects Reported for Acute and Chronic Exposure to Iron Compounds

Species	Form of Iron	Dose (mg/l)	Effect	Literature Citation
Ephemerella subvaria (mayfly)	ferrous sulfate	0.32	96-hr LC_{50}	Warnick & Bell [in 4-187]
Esox lucius (Pike) and "trout"	"iron"	1-2	death	Douderoff & Katz [in 4-187]
Gambusia affinis (mosquitofish)	ferric chloride turbid water	74	48-hr LC_{50}	[4-187, 217]
Daphnia magna (invertebrate)	ferric chloride	21	48-hr LC_{50}	[4-187, 217]
Roccus americanus (white perch)	ferric hydroxide flocs		c[illegible]at gills	Olsen [in 4-187]
Menidia (silversides)				

Notes: (from Table 4-327)
Ohio proposed ambient standard: 1.0 mg/l (total iron)
Typical Lake Erie concentrations: 0.05 mg/l (dissolved iron)
Typical levels projected for Lakefront Plant effluent 0.73 mg/l (dissolved iron) olved iron)
Typical levels projected for 250 meters (800 ft) from Lakefront Plant diffuser: 0.07 mg/l (dissolved iron)

Table 4-3?3

Effects Reported for Chronic Exposure to Cadmium Compounds[(1)]

Species	Conditions	Dose (mg/1)	Effects	
Pimephales promelas (fathead minnow larvae)	200 mg/1 hardness Exposed over life history	0.057 0.051-0.0245	Decreased survival No effect on survival, reproduction or growth	Pikering and Coast [4-219]
Lepomis macrochirus (bluegill)	200 mg/1 hardness	0.080	Effect on long term survival;	Eaton [4-218]
	11 months exposure	0.031	no significant effect on hatchability no effect on survival growth, reporduction observed	
Ictalurus punctatus (channel catfish)		0.017 0.012	Reduced survival and growth "no effects"	Eaton [in 4-187]
Salvelinus fontinalis (brook trout fry)	199 mg/1 hardness	0.012 (60 days)	Reduced length, weight and survival	Sauter, et al. [4-210]
Stizostedion vitreum Walleye (eggs - fry data not available)	199 mg/1 hardness	0.086	Did not effect hatchability	Sauter, et al. [4-210]

(1) Notes: (from Table 4-327)
Ohio proposed ambient standard: 0.0012
Typical Lake Erie concentrations: 0.001
Typical levels projected for Lakefront Plant effluent: 0.0014
Typical levels projected for 800 ft from Lakefront Plant diffuser: 0.001

observed at 0.057 mg/l for fathead minnows and 0.08 mg/l for bluegills. Eaton (4-96) also found reduced survival and growth of channel catfish fry at concentrations of cadmium, but water hardness was not reported. More recent work on the toxic effects of sublethal concentrations on fish egg hatchability and fry survival was done by Sauter, et al. (4-123) They found eggs to be more resistant than fry for brook trout and channel catfish with the effects level for the former the lowest reported. The maximum acceptable toxicant concentration (MATC) for brook trout was estimated to be between 0.007 and 0.012 mg/l. Similarly the MATC of cadmium for channel catfish fry in hard water was estimated at 0.012 - 0.017 mg/l. Walleye egg hatchability was not effected in concentrations of cadmium as high as 0.0867 mg/l, although fry data could not be obtained. Again, these figures are above concentrations predicted for the effluent under typical and worst case conditions.

4.925
Lead. As with other heavy metals discussed, the toxicity of lead to aquatic biota is affected by pH, hardness, and the presence of other materials such as organic matter. In very hard water (hardness values of 300 mg/l or more) reported TL_m values for rainbow trout, bluegills, and fathead minnows are all above 400 mg/l total lead. (4-96,116) In soft water, levels reported for salmonids (the most sensitive species tested) were between approximately one and six mg/l. (4-96,126) Levels toxic in Lake Erie water of intermediate hardness would be expected to fall between these two extremes. Therefore, it is expected that these toxic levels would not be approached by the predicted effluent. Holcombe, et al., (4-127) examined chronic effects of lead on three generations of brook trout (Salvelinus fontinalis) in soft water. Based on the occurrence of black tail and scoliosis (spinal curvature), a level between 0.059 and 0.119 mg/l total lead would be the maximum acceptable toxicant concentration (MATC) on the basis of his work. Sauter, et al., (4-123) also examining chronic effects in soft water, found MATC concentrations of lead for lake trout (Salvelinus namaycush) between 0.048 and 0.083. Rainbow trout, channel catfish (Ictalurus punctatus), bluegill (Lepomis Macrochirus), white sucker (Castostomus commersoni), northern pike (Esox lucius), and walleye (Stizostedion vitreum) were all less sensitive. Since Lake Erie water is significantly harder than that used for these tests, MATC values for it should be higher. In any case, the levels reported above are predicted only in the effluent itself. In summary, the lead concentrations predicted are not expected to have a toxic effect on the aquatic biota.

4.926
Chromium. Chromium, at low concentrations, may be a nutrient for both plants and animals. In natural waters with a pH between five

and nine, little soluble Cr^{+3} exists, since it is complexed as an insoluble hydrated oxide. (4-96, 113) Hexavalent chromium is considered irritating and corrosive to mucous membranes. In air, Cr^{+6} causes respiratory damage, skin effects, and lung cancer. Significant correlations between chromium concentrations in water supplies and resident population cancer mortalities were not found althouse these data are not considered conclusive. (4-96) Predicted concentrations of chromium in the proposed effluent are well below the "safe" levels determined by the experiments discussed below. Due to the concern for human effects, a limit of 0.050 mg/l total chromium has been set by EPA, recommended by IJC, and is the proposed Ohio Lake Erie standard. This level is not reached in the prediction of the proposed effluent under typical operating conditions. It may be exceeded under worst conditions, but is predicted to be below the level of the standard within a very short distance of the discharge port. Safe levels of hexavalent chromium for rainbow trout (Salmo gairdneri) have been reported at 0.300 mg/l based on studies that include reproduction. No difference in chronic level toxicity between Cr^{+6} and Cr^{+3} was observed for fathead minnows with 1.0 mg/l considered a safe level for both species of the metal. However, 0.20 mg/l of hexavelent chromium caused increased mortality and decreased growth in chinook fingerlings after 12 weeks. Fingerlings kept in similar concentrations of trivalent chromium did not exhibit response significantly different from those of controls. Reported effects levels for Daphnia magna were in the same range as for the more sensitive of the salmonids. (4-96, 113)

4.927
Fluoride. Observed increases of fluoride levels in water have increased awareness of its effects. Levels below two mg/l fluoride, generally have no effect on mottling of teeth in livestock. Water containing less than approximately one mg/l fluoride, will seldom cause this same effect even in very susceptible children. (4-113) Predicted maximum concentrations of fluoride in the effluent are below levels required by Ohio for public water supplies and are rapidly diluted to near ambient levels, an order of magnitude below the regulated standard, 250 meters (800-ft) from the discharge port. Under worst case conditions, concentrations could be sufficient to affect fish in the effluent itself, but modeled levels of fluoride are reduced to well below one mg/l at the 250 meter (800-ft) isopleth, and are not expected to create increased levels sufficient to affect public water supplies or fishes. In addition, the predicted concentrations are probably high, since it was assumed that maximum levels permitted would be found. Low use of fluorospar is anticipated at the lakefront plant compared to average steel mill usage thus resulting in lower than the maximum permitted concentrations.

4.928

Arsenic. Although arsenic is concentrated in aquatic organisms, there is no evidence of its being progressively concentrated along food chains. Discharge-related levels of arsenic, including those projected for the effluent itself, are well below regulated levels and levels observed toxic to aquatic biota. Lethally toxic concentrations and effects levels reported for various species of algae, invertebrates and fishes range from 0.500 to 11 mg/l as arsenic, with Daphnia magna being the most sensitive species observed. (4-96, 103) Conditioned avoidance behavior in goldfish was impaired by 0.1 mg/l sodium arsenate. Canadian Drinking Water Standards and Objectives, 1968 (subject to potential revision) lists 0.010 mg/l arsenic as an unacceptable level. (4-113) Regulated maximum levels (by Canada, EPA and Ohio) are 0.05 mg/l.

4.929

Residual Chlorine. Some chlorination would be utilized by the proposed facility. Background levels in Lake Erie are below 0.1 mg/l and are assumed negligible. Residual chlorine in the effluent is expected to be quite low. The 0.001 to 0.002 mg/l values estimated as typical for the effluent are within the range considered safe for salmonids, the most sensitive species for which effects are reported. If Lake Erie levels continue to be negligible, dilution to even lower levels would occur rapidly. Under the assumed worst case conditions, effluent level of residual chlorine could exceed levels recommended by the EPA for protection of salmonids. Again, if ambient concentrations continue to be negligible, rapid dilution to much lower levels would be expected.

4.930

Chemical Additives. Based on other experience with Lake Erie water, it is expected that three basic types of water treatment chemicals will be required to control the quality of water used in the indirect cooling water recycle systems. These are: (1) dispersants for deposit control; (2) corrosion inhibitors; and (3) biocides. Polymers will be required for the settling of solids in raw water clarification. Additives containing heavy metals as part of the active ingredients will not be used in these systems. A final decision on the specific additives (and quantities thereof) will not be made during the design phase of the proposed project. However, since these data have not been made available no assessment of the effects on the aquatic biota can be made at this time.

4.931

Manganese. Manganese concentrations in excess of 0.50 mg/l may cause objectionable taste and impart a brownish staining to laundry. This type of effect may be intensified by iron, which would be present with the manganese in the proposed effluent. The 0.05 mg/l level was

recommended to protect against these effects. (4-96) Predicted manganese concentrations in the effluent are approximately an order of magnitude greater than ambient lake concentrations. As a result, near ambient levels are predicted at 250 meters (800-foot) from the effluent port under typical conditions. Under "worst case" conditions, concentrations may still be elevated above high ambient levels at 250 meters (800-ft), but will be below required and recommended levels of 0.05 mg/l. No adverse effects are predicted. Freshwater fish tolerance levels for manganese range from 1.5 mg/l to over 1000 mg/l. Permanganates are more toxic (2.2 to 4.1 mg/l have caused fish kills in less than 24 hours). This latter form is not persistent as it rapidly oxidizes organic materials and becomes nontoxic. (4-96) Both of these reported effects levels are well in excess of the predicted concentrations of manganese in the effluent.

Solids

4.932
Dissolved Solids. Dissolved solids levels are high in Lake Erie, with ambient concentrations at or above proposed Ohio standards levels (see Table 4-356). The large increment in dissolved solids in the effluent will consist mostly of the ions of highly soluble salts. The species of principal interest, such as ammonia, chlorine, fluoride, and sulfide ions have been discussed above, while cyanide has been included in the discussion on organic contaminants below. Significant changes in pH, once mixing with lake waters occurs, are not expected. Sulfate concentrations could be as high as twice ambient concentrations (e.g., 60 mg/l). These levels are below reported effects levels for aquatic species as well as below proposed Ohio Standards. Nitrates, nitrites, and phosphates are all nutrients. Levels of these constituents have been increasing in Lake Erie over the last century. Since additional loadings of nitrates and nitrites from the proposed discharge were not quantified, and because limiting factors on algae growth in the vicinity of the discharge have not been established, it is not possible to estimate the effect that additional loadings of these materials will have on the already eutrophic system. Based on phosphorous levels in the effluent from the biological treatment system at the U.S. Steel Fairfield and Clairton Plants (analogous to that proposed for Lakefront) no significant additions of phosphates are anticipated. Dissolved organic material would also be added by the proposed facility, although due to the volatility of many of the low molecular weight soluble organics, these may or may not be observed in dissolved solids measurements. Slight increases in oxygen demand are expected although they are not predicted to reduce dissolved oxygen levels below biologically safe concentrations (e.g., 5 to 6 mg/l).

4.933
Suspended Solids. Suspended solids levels in Lake Erie can be high and are largely made up of organic material. However, sampling data near the proposed plant site indicate predominance of inorganics. Increments due to plant operations would be both organic and inorganic in nature. In general, the potential for the types of suspended sediment impacts discussed earlier in this section under Construction Effects would be less for the main wastewater discharge, because concentration in the discharge would not be expected in the same order of magnitude as during construction activities, especially in Conneaut Harbor. The inorganic fraction of discharged suspended solids could include insoluble materials such as iron oxides and precipitates of other heavy metals. It is not known what fraction of the metals discharged will be soluble and what fraction will be dissolved. In most cases, the total amounts discharged were assumed to be soluble for the purpose of discussing toxic effects to aquatic species. However, it is probable that a significant amount of these metals may become absorbed onto suspended solids which may settle to form sediments, become absorbed directly onto sediments; or precipitate independently. In any case, nearfield and/or farfield sediments are likely to serve as sinks for such contaminants. Uncertainty over such partitioning makes it difficult to predict subsequent sediment levels and further, biological uptake of these materials. A significant fraction of discharged organic material would be associated with the suspended solids. The toxic effects of possible constituents, where known, are included in a separate discussion below. Some of the same organic materials could also be dissolved in "oil and grease" fractions. As with dissolved organic material, this will tend to increase oxygen demand, either in the water column or the sediments with which they may become associated. Due to the high organic content of Lake Erie suspended solids and sediments, accumulation of some organic contaminants in sediments could result in their bioaccumulation.

Organic Contaminants

4.934
Cyanides. Undissociated hydrogen cyanide (HCN) is essentially the toxic cyanide species in simple cyanide solutions. In any case, below a pH of 8.0, most free cyanide exists as HCN. In animals, it is a non-accumulative poison, inhibiting oxygen metabolism at the cellular level. In water quality measurements, Cyanide A or amenable cyanide, is essentially HCN (at effluent and Lake Erie pH levels) and hence toxic to fish. Predicted typical levels of Cyanide A, even in the effluent prior to dilution, are below lethally toxic levels and close to upper safe limits reported by some authors. Within 10 meters of the port the predicted concentration in the centerline of the plume would be below the sublethal effects levels reported.

Under "worst case" conditions, the concentration of cyanide A in the effluent itself approaches the lowest numbers reported to be lethal. Within 50 meters of the port, the centerline of the plume contains predicted concentrations at or below most sublethal effects reported (0.01 mg/l and at 90 meters from the port a 0.005 mg/l level is achieved). Cyanide has been shown to be acutely toxic to most fishes in a short period of time. Although existing data give somewhat conflicting values for toxicity, dissolved oxygen, temperature and pH play a significant role in the toxicity of cyanide. These parameters are not always reported in earlier studies. Low dissolved oxygen and increased temperature (especially the former) increase the toxicity of CN to fishes. (4-96, 105) In a review of cyanide toxicity literature, Doudoroff (4-128) found that most tolerance limits reported for free cyanide with juveniles and adult fish in static bioassays were 0.1 to 0.3 mg/l. Lower and higher values have been reported. For example, Brown (4-105) listed 0.01 ppm CN as a 48-hour median lethal threshold for rainbow trout with similarly low results reported for bluegills by Renn. (4-105) Doudoroff noted that lower threshold values were frequently obtained by extrapolation which tend to give estimates lower than observed values. (4-128) Higher values can be questioned in static tests due to losses of free cyanide from solution.

4.935
Some toxicity data have been summarized in Table 4-364. Cardwell, et al. (4-129) found that fathead minnow and bluegill (at 25°C), were more sensitive to sodium cyanide than brook trout (at 15°C), channel catfish or goldfish (at 25°C) in intermittent flow bioassays. Median lethal concentrations (LC_{50}) for the fathead minnow were 0.326 mg/l to 0.114 mg/l. Broderius (4-96), however, found brook trout to be more sensitive to cyanide toxicity at 10°C in a continuous flow bioassay than bluegills or fathead minnows at 25°C. Downing (4-130) found median survival time of rainbow trout was less than 100 minutes in solutions of 0.116 to 0.155 ppm cyanide at oxygen concentrations near 100 percent saturation. Reducing oxygen levels to below 50 percent saturation reduced survival time to less than 10 minutes. In an examination of chronic effects of cyanide of the fathead minnow, Lind, et al. (4-131) listed the highest "no-effects" level of HCN for the fathead minnow at between 0.0129 and 0.096 mg/l. However, much of the cyanide present in the effluent would be chemically complexed with other constituents. The levels of total cyanide are estimated as eight times the free cyanide levels. Data cited in the "Water Quality Impact" sections of this chapter indicates that thiocyanate complex (CN_5) probably accounts for the vast majority of the complexed cyanide in the untreated waste waters, at least that portion that is in the coke plant effluent. However, this parameter has been found not to contribute to the total cyanide measurement, and sometimes to subtract from the measured amount of free cyanide.

Table 4- 3Ր4

Effects Reported for Acute and Chronic Exposure to Free Cyanide[1]

Species	Conditions	Dose	Effect	Literature Citation
Pimephales promelas (fathead minnow)	O_2 - 78% saturation pH 7.6 - 7.8 25°C	0.326 - 0.114 mg/l	LC_{50} (1.4 - 250 hours)	Cardwell, et al. [4-223]
Salvelinus fontinalis (brook trout)	10°C	0.057 mg/l	Lethal threshold	Broderius [in 4-187]
Lepomis (bluegills)	25°C	0.104 mg/l	Lethal threshold	Broderius [in 4-187]
Pimephales promelas (fathead minnow)	25°C	0.120 mg/l	Lethal threshold	Broderius [in 4-187]
Salmo gairdneri (rainbow trout)		0.01 ppm	TLM	Brown [in 4-195]
Salmo gairdneri	100% O_2 saturation	≥0.2 ppm	25% survived less than 10 minutes	Herbert and Merkins [4-224]
Salmo gairdneri	O_2 near 100% saturation 17°C pH 7.8 - 8.2	0.116 - 0.155 ppm	Survival time <100 minutes	Downing [4-225]
	O_2 below 50% saturation	0.116 - 0.155 ppm	Survival time <10 minutes	
Pimephales promelas		≥0.0196 mg/l (256 days)	Egg production reduced	Lind, et al. [4-226]
		0.044 - 0.728 mg/l	Egg hatchability reduced	
		0.0129 - 0.196 mg/l	"No effects"	
"Trout"	7 - 9°C DO of 11 ppm	0.11 ppm	Loss of equilibrium in 2 hours	Southgate et al. [in 4-195]
	DO of 3 ppm	0.11 ppm	Loss of equilibrium in 10 min	
Salvelinus fontinalis		0.010 mg/l	Reduced swimming ability	Neil [in 4-187]

(1) Notes: (From Table 4-327)
Ohio proposed Ambient Standard: 0.005 mg/l (cyanide A)
Typical Lake Erie concentrations: 0.0002 mg/l (cyanide A)
Typical levels projected for effluent: 0.017 mg/l (cyanide A)
250 meters (800-ft) from Lakefront Plant diffuser: 0.0008 mg/l

(4-132) Thiocyantes are almost completely degraded in biological treatment systems, if the residence time is as proposed for the lakefront plant, so that very little may be present in the treated effluent. The thiocyanate ion is not nearly as toxic as free cyanide. Extensive bioassay data is not available. However, the lowest effects reported were for Gambusia holbrooki (mosquito fish) where harmful effects were observed in 10-day tests with concentrations of KCNS over 58 mg/l as CNS. No rainbow trout were killed in static bioassay concentrations of NaCNS as high as 1800 mg/l as CNS. Lethal concentrations of NH_4CNS were lower (above 100 mg/l) but the effects of free ammonia were probably contributing to toxicity. (4-128)

4.936
Quantities of ferrocyanide could be of the same order magnitude as free cyanide concentrations. Other metal-cyanide complexes are expected in trace quantities. Due to their insolubility, nickel and copper cyanide complexes are not very toxic to aquatic species. Zinc and cadmium complexes can dissociate into complex ions which are at least as toxic as hydrocyanic acid. These complex ions form when the metals are available in very low concentrations compared to cyanide, as is the case in effluents from the proposed facility. It has not been possible to predict levels of these two metal ions in the proposed discharge. If, as expected, they are present in trace quantities, toxic effects levels would not be expected. (4-128) The iron-cyanide complexes may be present at levels similar to those of free cyanide. These complexes are not very toxic to aquatic species, however, they are subject to photodecomposition in direct sunlight, releasing free cyanide. This reaction is reversible at night. (4-96, 128) As the effluent port is to be located near the bottom at the 10 meter contour, concentrations of iron-cyanide complexes in the plume as it hits the surface would be of most concern. The following case was considered:

- The plume hits the surface 50 meters from the port
- Concentrations of iron-cyanide complexes are similar to free cyanide concentrations.
- All iron-cyanides have decomposed (which would not happen in the short term but reflects a "worse than worst" case)
- Under worst case conditions free cyanide concentrations are 0.010 mg/l, in the centerline of the plume 50 meters from the port.

4.937
These are conservative (high levels) assumptions. In this instance, surface concentrations of cyanide could reach 0.06 mg/l (from Fe(CN$^-$ $^{2}{}_{6}$). This is at or below lower toxic levels reported for fishes. Under lower ambient current speeds, the plume could hit the surface in a shorter distance resulting in somewhat higher concentrations (assuming all the iron-cyanides decomposed). Toxicity at these lower levels would require that they remain this high or higher for 48 hours or more. This is not likely due to reformation of the iron complexes at night and, by definition, 24-hour duration of "worst case" effluent conditions. Thus, even assuming that all worst case possibilities occur simultaneously, acutely toxic effects from cyanide are not expected. Sublethal effects, such as reduced swimming ability, might be observed for some species if the above levels were reached. As long-term concentrations of these elevated levels are not expected, other sublethal effects on growth, etc., are not expected.

4.938
Phenols. A variety of phenolics are anticipated in the effluent. Unfortunately, most field measurements taken group this family under "phenols" and can include a wide variety of substituted species, including chlorophenols. In bioassays examining the effects of these constituents, specific compounds are examined. A review of current literature provided information on "phenols" and "chlorophenols" as specific compounds. Operation of the proposed facility is predicted to add considerable amounts of phenolics compared to ambient levels. However, predicted levels of all phenolics in the effluent do not even approach acute toxicity levels reported for phenol which is only a small amount of the phenols in the effluent. Under worst case conditions, phenolics in the effluent are an order of magnitude below the reported 1.0 mg/l effects level of phenol on rainbow trout. The predicted levels are based on the assumption that the coke plant and blast furnace treatment plants are operating at maximal allowed BAT levels. In practice, US Steel has experienced that similar treatment plants produce concentrations below these levels. Levels of chlorophenol that cause tainting in carp are also not approached in the prediced effluent.

4.939
The poisonous effects of phenol have been ascribed to a specific action on the nervous system. (4-133) Fish exposed to lethal concentrations soon become excited, swim rapidly, become more sensitive to outside stimuli, and show increased respiration. (4-134) In addition, there may be color changes (4-134) and increased mucus secretion. (4-134) Death may occur quickly or after a stage of depressed activity, loss of equilibrium, and occasional convulsions. (4-134) The available findings are summarized in Table 4-365. In

Table 4- 3°5

Lethal Effects of Phenol on Fish

Species	Concentration of Phenol mg/l	Measurement Standard	Water Temp. Degrees C	Specimen Age
Rainbow trout	4.0	18-week LC_{50}	14-18	-
Rainbow trout	5.0	24-hour LC_{50}	18	embryo
Rainbow trout	11.0	24-hour LC_{50}	12-14	1-yr.
Rainbow trout	7.5	24-hour LC_{50}	12-14	3-yr.
Rainbow trout	9.3	48-hour LC_{50}	15	-
Rainbow trout	9.8	48-hour LC_{50}	17	-
Rainbow trout	9.8	48-hour LC_{50}	18	-
Rainbow trout	8.0	48-hour LC_{50}	12	-
Rainbow trout	5.0	48-hour LC_{50}	6	-
Rainbow trout	5.0	48-hour LC_{50}	12-13	juvenile
Rainbow trout	3.0	48-hour LC_{50}	3-4	juvenile
Rainbow and Brown trout	>40.0	5-day LC_{50}	-	eyed eggs
Rainbow and Brown trout	>40.0	5-day LC_{50}	-	1-day-old alevins
Rainbow and Brown trout	>60.0	5-day LC_{50}	-	3-day-old alevins
Rainbow and Brown trout	<10.0	5-day LC_{50}	-	10-day-old alevins
Trout	1.3	threshold	-	-
Atlantic Salmon	5.0	5-day LC_{50}	10	fry
Coho Salmon	3.2-5.6	72-hour LC_{50}	6-11	-
Bitterling	20.0	threshold	-	-
Bluegill Sunfish	11.5-20.0	96-hour LC_{50}	-	-
Crucian Carp	25.0	24-hour LC_{50}	18	-
Crucian Carp	25.0	129-hour LC_{50}	12-14	-
Goldfish	44.5	48-hour LC_{50}	25	-
Gudgeon	25.0	48-hour LC_{50}	10	-
Perch	12.0	threshold	-	-
Perch	15.0	24-hour LC_{50}	18	-
Roach	12.0	threshold	-	-
Roach	14.5	24-hour LC_{50}	18	-
Roach	25.0	24-hour LC_{50}	18	-
Tench	17.0	24-hour LC_{50}	18	-

Source: European Inland Fisheries Advisory Commission Working Party on Water Quality Criteria for European Freshwater Fish: Food and Agriculture Organization of the United Nations. Water Research, Pergamon Press, 1973.

general, salmonids are more sensitive than coarse fish, and fry are more sensitive than adults. The concentrations shown to be lethal usually fall within the range of 4 to 11 mg/l for salmonids and 12 to 25 mg/l for coarse fish. Invertebrates appear to be even less sensitive. Forty-eight hour LC_{50} data ranged from 100 to 280 mg/l for various species of freshwater turbellaria, nematodes, oligochaetes and hirundinea. (4-135) Similar investigations give 48-hour LC_{50} data in 14 mg/l for Daphnia longispina, 132 mg/l for the Ostracod Cypris pubera, and values all above 180 mg/l for various molluscs. (4-136) These lethal concentrations depend on several environmental factors. The toxicity of phenol to rainbow trout is increased by a lowering of the dissolved-oxygen content, or decrease in temperature. A reduction in dissolved oxygen from 100 percent to 50 percent of the air-saturation value has been shown to reduce the estimated long-term LC_{50} by about 20 percent. (4-134) A decrease in temperature from 12°C to 3°C changed the 48-hour LC_{50} value from 5 to 3 mg/l. (4-134)

4.940
Fish surviving long-term exposure to low concentrations of phenol show general tissue inflammation and necrosis. Hemorrhage and degenerative changes have been demonstrated in several tissues, including skin, muscle, gills, liver, spleen and kidney. (4-134) Sublethal exposure also produces a decrease in the number of erythrocytes and a high count of abnormal and juvenile blood cells. (4-134) At higher concentrations of phenol, (greater than 6 mg/l) the blood cells are destroyed. (4-134) Activities of three blood plasma enzymes were found to be significantly elevated with sublethal exposure. (4-137) In sturgeon prolarvae (yolk-sac larvae) exposed to phenol throughout development, the skin remained unpigmented and the eyes became only slightly pigmented. (4-138) Phenol has been shown to decrease the amount of neurosecretory material present in the guppy. (4-139) Differences have not been demonstrated between control and phenol-effected specimens in blood hemoglobin or in total plasma protein. (4-133) Sublethal concentrations of phenol effect fish growth. Weight loss was observed in common carp exposed for two months to 12.5 mg/l of phenol. (4-134) In rainbow trout, a 1.0 mg/l concentration of phenol produced a 20 percent reduction in growth. (4-134) Phenol has also been shown to cause decreased sexual activity. (4-134) Reports suggest that fish exposed to phenol are more susceptible to disease, but the extent of this effect has not been shown. (4-134) Phenol itself has not been shown to impair the taste or odor of fish. Neither short-term exposure to 25 mg/l (4-134) nor four-day exposure to 2.5 mg/l (4-134) produced a detectable taint. Phenolic flavor may be acquired by fish eating contaminated food, for example worms kept in water containing phenol. (4-134) The flavor may in turn be picked up by animals feeding on tainted fish. (4-134)

4.941

Chlorophenols. Limited information is available on the specific impact of the chlorophenols on fish. Research with pentachlorophenol indicates that this compound appears to affect numerous phases of fish metabolism, altering growth, food conversion efficiency, appetite, fat and protein deposition, swimming stamina, the level of ATP in tissues, and the activities of certain enzymes. (4-140) The mechanism for these alterations involves, in part, a switch in the pathways of fish carbohydrate catabolism. Catabolism alteration has been shown to occur after exposure to cichlids to 0.20 ppm of pentachlorophenol. (4-140) A congruent indication of probable disruption in fish energy metabolism by pentachlorophenol is the observed increase in the oxygen consumption rate. (4-141) Studies on the relative sensitivity of early developmental stages to pentachlorophenol have shown that juvenile steelhead trout are more tolerant to PCP than either alevins or embryos. The observed mortality rate was 100 percent in embryos developed at 40 ppb NaPCP, and nearly 100 percent in alevins held at 70 ppb NaPCP. Juveniles held at 70 ppb NaPCP for three weeks, however, showed growth retardation but little mortality. (4-141) A more common effect of the chlorophenols on fish seems to be a taste and odor produced after short-term exposure. The only information available indicates that an undesirable taint occurs in common carp at concentrations as low as 0.015 mg/l or o-chlorophenol and 0.06 mg/l of p-chlorophenol. (4-142) The uncertainty of exact amounts and types of organic compounds in the effluent combined with the paucity of effects data (especially for sublethal levels) renders prediction of the impact, especially regarding bioaccumulation; relatively difficult. Acutely toxic levels, based on data reported above, are not expected. Levels of volatile components should decrease fairly quickly given the surface area available, although these compounds may reenter, less concentrated, with rainfall. Sufficient information is not available to predict the long-term fate or effects of the expected low concentrations of these materials.

4.942

Other Organics. In general the concentrations of organic components in the effluent are expected to be below those of inorganic constituents (except cyanide, which can be considered in either category). Of the non-chlorinated organics (refer to Table 4-366) the group phenols are likely to be present in the highest amount and several members of that group have also been discussed separately above. Based on available steel plant effluents data, it is estimated that other non-chlorinated organics will be present in concentrations lower than phenol. They would range in concentration from below one ppb (g/l) for the more concentrated species, to below one ppt (0.001 g/l). In one unverified report from the Soviet Union, a polynuclear aromatic hydrocarbon (3,4 benze-pyrene) was reported to be present at a 0.3

Table 4- 36C

Priority Pollutants That May be Present in Wastewaters from a Steel Mill

Organics (Not Chlorinated)[1]	Organics (Chlorinated)[2]
Phenol	Chlorinated benzenes (3)
Benzene	Chlorinated ethanes (70)
Toluene	Chlorinated naphthalene
Ethylbenzene	Chlorinated phenols (2)
Dimethyl phenol	Chloroform
Dinitrotoluene	2-Chlorophenol
Naphthalene	Dichlorobenzenes (3)
Fluoranthene	2,4-Dichlorophenol
Polynuclear aromatic hydrocarbons (13)	Dichloropropane (2)
	Halomethanes (8)
	Pentachlorophenol
	Tetrachloroethylene
	Trichloroethylene

(1) Listed in order of expected concentration, highest first.

(2) Not listed in any special order.

Note: Chemicals listed as given in the original list associated with the EPA Settlement Agreement. Numbers in parentheses after a chemical classification indicate the number of specific chemicals in that class that were subsequently specified by the United States Environmental Protection Agency.

Source: Arthur D. Little, Inc. estimates.

ppb level in the effluent. Chlorinated hydrocarbons are expected to be well below one ppb for any specific chemical. In addition to process waste organic materials, many of which are aromatic or short chain aliphatics, long chain hydrocarbons (petroleum derivatives) are also expected. These compounds will add to oil and grease levels already in Lake Erie. It is also expected that some of the less water soluble organics could be dissolved in the oil fractions of the effluent. A number of the lighter weight compounds are highly volatile. Thus, their effects, if any, would be observed in the plume at the surface over a short distance, with distance/time allowing for volatilization. This would be true for example, for chloroform, the chloroethanes, benzene, and toluene. Similarly, organic materials from cooling towers could be added to the effluent. Information on the toxicity of many of these compounds is sparse at best, with information on sublethal effects and bioaccumulation even less well documented. Much of the available information describes effects on marine species. In one study, where lethal concentrations for a number of organic species were computed, the marine silversides showed sensitivity similar to that demonstrated by the fresh water bluegill. (4-143)

4.943
A number of investigators have examined toxicity of some smaller hydrocarbons. Table 4-367 compares the results of tests done with small freshwater sunfish at 20 ; goldfish in a continuous flow bioassay; and young coho salmon in artificial sea water at 8°C. (4-144, 145, 146, 147) In another study with pacific herring (Clupea harengus pallasi), 100-800 ppb benzene administered 48 hours before spawning significantly reduced survival of ovarian eggs, embryos, and larvae. The latter were most sensitive. Benzene was accumulated in eggs up to 14 times the initial 0.1 mg/l concentration in 24 to 48 hours. (4-143) It appears that if aquatic species can withstand initial concentrations of naphthalene and even benzopyrene, that some can metabolize these compounds. One study has indicated that rainbow trout can metabolize benzo(a)pyrene. (4-148, 149) The issue is complicated by the fact that intermediate or excreted metabolites may be more toxic. (4-150) Attention has been paid to the fate of carcinogens such as 3,4 benzpyrene, and other polycyclics. In marine bacteria 100 M of napthalene was as toxic as 0.2 M of benzopyrene (4-151) while not directly applicable to fishes, it would appear to be more acutely toxic. The issue of bioaccumulation of benzo(a)pyrene is not clear. One study in Russia found that this substance, present in seawater at 0.01 or 0.1 g/l was accumulated by mussels but not by whiting or Spicara smaris after prolonged exposure. (4-152) If one accepts that a high octanol/ water partition coefficient is indicative of high probable bioaccumulation, then benzopyrene can be expected to accumulate to a far greater extent than biphenyls or P-dichlorobenzene. Predicted and measured values for

Table 4- 3?7

Reported Toxicity Data on Selected Organic Compounds

Organic Compound	Coho Salmon	Sunfish	Goldfish	Pink Salmon Fry
	Species Tested			
Toluene[1]	50 ppm/near 100% mortality in 24 hrs	61-56 ppm/100% mortality in 24 hrs	40.59 ppm/24 hr LC_{50}	
Xylene[2]	100 ppm/100% mortality in 24 hrs	47-48 ppm/100% mortality in 1 hr	30.50 ppm/24 hr LC_{50}	
Benzene[1]	50 ppm/60% mortality in 24 hrs	35-37 ppm/100% mortality in 1 hr		
Ethyl Benzene[2]	50 ppm/100% mortality in 24 hrs			
Naphthalene[2]		405 ppm/100% mortality in 1 hr		112-250 ppb/24 hr. TLM
1,3,5, Trimethyl Benzene[2]			20.57 ppm/24 hr LC_{50}	

(1) Presence in the effluent considered unlikely above 1 ppm

(2) Presence in the effluent considered unlikely above 1 ppb

the latter two compounds are available and two orders of magnitude lower than would be predicted by this method for benzo(a)pyrene (see the Water Quality impacts section of this chapter). As mentioned above, evidence exists to indicate metabolism of benzo(a)pyrene in trout. Another investigator has shown that mussel containing high benzo(a)pyrene concentrations, rapidly release the higher concentration of this material, but require two to three weeks to eliminate residual aromatic hydrocarbons. (4-153) Finally, benzo(a)pyrene is decomposed in sunlight, and the rate of this reaction is increased at high oxygen levels. (4-154) Thus, during ice free seasons, some of these aromatic hydrocarbons would be lost as the effluent plume spreads out at the surface. Oil and grease components in the effluent may contain some of the above-mentioned contaminants, and hence have toxic potential. As the volatile components evaporate, these oils should become less toxic, especially if concentrations remain low. However, two potential problems with these insoluble organics exist. Emulsified in seawater and containing dissolved, unsaturated aliphatic and aromatic compounds, colloidal oils have been noted to taint fish (noticeable flesh odor). (4-155) Furthermore, oils can, if quantities are sufficient, for contact to occur, cause the following impacts: coat gills or other respiratory surfaces causing asphyxiation in the nektonic, zooplanktonic or benthic portions of a community; cause loss of buoyancy, insulating capacity or mobility in waterfowl. (4-96, 156) These effects are more typically observed following oil spills and are not expected with the smaller amounts of "oil and grease" in the effluent of the proposed facility.

Effects of Combined Contaminants

4.944
Bioassays that deal with single or combined contaminants under a limited set of test conditions share the liability that they may not be totally applicable to an effluent containing a large number of constituents. Additive, synergistic, and antagonistic interactions among various components of an effluent stream may render it, more or less, toxic than individual or even combined contaminants. The use of bioassays with resident species and specific concentration of the effluent itself combined with receiving waters are a far better predictive tool. This is especially true in the case of the proposed facility. Not only does the combination of treatment processes present a new situation, but the actual short-term (and long-term) chemical fate of many components can only be approximated. Further, very little is known about the chronic toxicity of some of the organics expected in the effluent. The following list is presented as an indication of some of the toxic effects observed when different contaminants are applied in combination. It is intended to be indicative of possible additive, synergistic, or antagonistic effects of

combined contaminants or variations in environmental situations. These types of interactions are as follows:

- Increases in temperature can increase the rate of uptake of a toxicant; increases in detoxifying mechanisms can counterbalance this in some cases.

- Preliminary results with centrarchids in five-hour static tests indicate increased accumulation of lead and chromium at 30°C compared to 24°C. This was not observed with cadmium. (4-157)

- There is a decrease in survival time of fishes exposed to cyanide, zinc and possibly other metal ions at higher temperatures. However, there is an increase in $HgCl_2$ uptake by estuarine crabs below 5°C and phenols may be more toxic to fishes in winter. (4-158)

- Phenols and oil refinery wastes were more toxic to a green algae at 24°C (its optimal growth temperature) than at either 20°C or 28°C. (4-159)

- Free cyanide and ammonia appear to be synergistic with concentrations near or below lethal threshold levels of individual toxicants. (4-128)

- Cyanide complexes with copper, and iron are less toxic, but dilute concentrations of cyanide with zinc or cadmium are at least as toxic as free cyanide (see discussion under cyanide). (4-128)

- Cyanide with pentachlorophenate of potassium appears to result in a less than proportionately additive toxic interaction. (4-128)

- Zinc and copper effects are additive when proportions of incipient lethal levels equal one. In stronger mixtures they appear to be synergistic. (4-160, 161)

- Ammonia and phenols appear to have an additive effect. It appears that this also applies to zinc and ammonia and copper and ammonia (except copper sulfate, which may be antagonistic). Zinc and phenol and NH_4, where zinc predominates, appears to have a less than proportionately additive effect. (4-104)

- With a unicellular algae, zinc and copper or zinc and cadmium (where zinc predominated) appeared to be similar in toxicity to equal concentrations of zinc. Cadmium and copper together enhanced algae growth. (4-162)

- Copper toxicity is reduced by humic substances and organic matter such as that provided in sewage effluents. (4-163)

- Young of the year bluegills exposed to hydrogen sulfide (0.0015 to 0.46 mg/l) for 126-148 days showed decreased swimming endurance but an increased resistance to copper. (4-164)

Impacts of Abnormal Events

4.945
In general, EPA requirements for spill prevention plans have resulted in certain contingencies being designed into the Lakefront Plant such as protective diking. Some new spill/risk potential would exist, especially where small surface water bodies were intersected by transportation routes leading to or from the proposed plant. Leaks or spills from chemical storage areas, if not cleaned up, would have the most likelihood of severely impacting Conneaut Creek or the Turkey Creek watershed. The effects of high concentrations of chlorine, or hydro-carbon and oils have been discussed above. Extreme changes in water pH due to spills of acids or bases could alter the toxicity of other compounds in the water or sediments, or if extreme enough directly affect aquatic organisms. (4-187) Conneaut Creek would most likely afford more rapid dilution, and hence less long-term impact of such spills. Even if cleaned up, increased levels of contaminants could be present in runoff, and hence effluents from holding ponds. A large oil spill from surface vehicles into Conneaut Creek or into Lake Erie due to a rupture in the protective dike (less likely) could have far greater impact. Over the short-term, such products contain toxic materials, although many of the major fractions of these substances are volatile. Over the long-term, smothering effects could impact creek or harbor communities or lake nearshore communities. Impacts of a late fall, winter, or early spring event would be more severe due to the presence of migrating waterfowl and highly sensitive fish juveniles.

4.946
The impacts of malfunctioning wastewater treatment systems or a power failure on Lake Erie biota would be highly condition-specific. The greatest impact of such an event would occur if combined with onshore currents or low current velocities, resulting in less rapid dilution

of the increased toxicants, and concentration in the relatively productive nearshore area. Such a situation could allow sufficient exposure to toxic levels of contaminants to result in adverse effects on sensitive biota. Again, populations of juveniles would be the most sensitive to such a situation. This type of situation is highly unlikely because of the interdependent nature of the prediction and pollution-control aspects of the plant operations.

The Effect of the Proposed Plant Operations on Turkey Creek

4.947
Operational phase impacts on Turkey Creek can occur as a result of the proposed culvert and mitigation plan and from surface water runoff. Operational impacts which are associated with the proposed mitigation plan include those resulting from changes in streamflow patterns, introduction of Lake Erie water to Turkey Creek, and loss of some biotic and nutrient input ordinarily derived from vegetated streambanks. To offset or reduce the magnitude of some of the impacts, the applicant proposes to enhance and develop remaining unaltered stream habitats in a manner recommended by appropriate resource agencies. However, since the feasibility of effectively compensating for the loss of over a mile of prime stream habitat is speculative, the following discussion will emphasize and assume worst case conditions.

4.948
Replacement of 7,500 feet of natural meandering streambed by a comparatively straight 5,600-foot culvert could effect hydraulic perturbations throughout the watershed (i.e. increased drainage rates and flow velocities). Culvert usage without appropriate amelioration could further aggrevate seasonal impacts on upstream pools, especially during dry periods when aquatic biota could possibly be subject to stress conditions (i.e. elevated water temperature, low DO). Since many of these pools become isolated in late summer, increased drainage rates could result in pool desiccation thus extirpating remaining (trapped) fish populations. Unimpeded flow conditions inherent with culvert structures could also contribute to downstream scouring, erosion and siltation, particularly during freshets when these impacts are accentuated. At the downstream terminus of the culvert, flora and fauna communities would be disturbed and possibly reduced. In general, the induced stress conditions brought about by the changes in hydrologic conditions could diminish existing species diversity and productivity throughout the watershed. However, the intensity of these impacts could probably be minimized by the installation of strategically placed baffles, wiers, and siltation screens. Also, if flow augmentation is required by the State resource agencies, the additional water may result in a backwater effect which would tend to slow the drainage of upstream areas.

4.949
Detrital material as a result of leaf fall from deciduous streambank cover contributes metabolic nutrients as well as providing an energy subsidy to a stream ecosystem. Insects falling from overhanging vegetation also contribute to running water ecosystems. Approximately 7,500 feet of stream with vegetated banks will be lost by the culvert. However, detrital material and insects will continue to enter the stream from undisturbed portions of Turkey Creek. The 7,500-foot stretch of creek proposed for culverting will be unable to support rooted aquatic vegetation and will exhibit low diversity and productivity of benthos. This would tend to decrease the overall productivity of the stream.

4.950
The culvert by shading nearly a mile of Turkey Creek should result in slightly lower water temperatures in the lower reaches. Lower water temperatures, in addition to aeration effects of the baffle system, should maintain high levels of dissolved oxygen. The culvert will be in the bottom of a former ravine and fill will be placed over the culverts. The soils surrounding the culvert will be of relatively constant temperature year-round. This should result in more constant water temperature in the culverted section of stream with temperatures expected to be slightly warmer in winter and colder in the summer.

4.951
Introduction of Lake Erie waters during low flow periods as proposed in the applicant's mitigation plan, may affect the biotic composition of lower Turkey Creek. Subtle changes in physical and chemical parameters (i.e. trace elements, water temperature) could alter certain sensitive species and their community equilibrium dynamics and/or encourage success of species not presently inhabiting the creek. Further, planktonic organisms from Lake Erie will be artificially added to Turkey Creek; including ichthyoplankton, zooplankton, phytoplankton and microbial organisms. Some of these may thrive to the competitive exclusion of natural creek biota, while others may mutually co-exist or simply die off as conditions preclude survival in the new environment. Whether or not these changes are ecologically desirable or are significant is difficult to assess. No data is available that would provide a realistic or comparative basis for analysis. Monitoring program would be needed to accurately determine impacts. However, at certain times of the year when the sand-gravel bar at the mouth of Turkey Creek is absent, mixing of Lake Erie and Turkey Creek waters occurs in the lower reaches apparently without any severe impact on the stream biota. During the summer, the temperature differential between Lake Erie water (30-foot contour, bottom) and Turkey Creek water is small and thus augmentation of flow should not adversely affect indigenous warmwater species of fish. As

indicated earlier, significant differencies between Lake Erie and Turkey Creek water quality parameters were not identified.

4.952
The overhanging banks and vegetation of 7,500 feet of creek will be lost as protective cover for fish. While the culvert itself will provide protection for fish from aerial predators and mammals, there will be little cover for forage fish hiding from predator fish.

Primary Impacts of Surface Runoff

On-Site Impacts

4.953
Spillage of materials during plant operations as well as atmospheric fallout of plant emissions are collected and removed by surface water runoff following rain storms. In addition, runoff contains pollutants washed out of the atmosphere by falling rainwater. This surface runoff, subsequent to some settling in holding ponds, would be discharged primarily to Lake Erie. As a result of the current plan to install a culvert in Turkey Creek instead of diverting it to Conneaut Creek, most stormwater runoff from developed portions of the site will be diverted to the lake rather than Conneaut Creek. Undeveloped areas in the Turkey Creek drainage would flow undisturbed to the creek.

4.954
Lake Erie has the greatest assimilative capacity of all potential receiving waters on site. Runoff from developed areas on the site is expected to contain phenols, cyanides, ammonia, suspended solids, some oil and grease, as well as concentrations of a variety of heavy metals. Excluding "fallout" contributions, runoff from undeveloped areas is expected to contain much lower quantities of these same constituents. Shoreline waters in the immediate vicinity of the discharges may contain elevated levels of these contaminants, but rapid dilution is expected. As runoff volumes compared to receiving waters are very low, concentrations at levels acutely toxic to aquatic species are not anticipated. The impact of an oil spill could be significant and is discussed earlier in this chapter.

4.955
Runoff from slag storage areas as well as leachate and runoff from solid waste disposal areas will contain many of the same contaminants, with as many metals as sulfates as well as metal oxides and some alkalies. Runoff from the slag storage area would be collected and treated in accordance with regulatory standards and/or requirements, and would most likely be discharged into the lake. The solid waste disposal areas will be considered to be industrial point

sources and will require additional treatment. To meet these additional requirements, leachate will be recirculated back to the disposal area.

4.956
Runoff from coal blending areas, and possibly other raw materials storage areas, is expected to be treated by retention and, if necessary, in the plant process wastewater treatment system. While analogous runoff materials have not been treated extensively to date, Conneaut Creek appears to have sufficient volume to dilute acute toxicants. Thus, it has been possible to successfully release even sensitive salmonids into this creek. Net increments in toxicant loadings due to increased raw materials storage are not expected, due to the development and implementation of extensive treatment plans by the P&C Dock Company.

Off-Site Impacts

4.957
It is assumed that atmospheric fallout of most plant air emissions will decrease with distance from the plant. Similarly, atmospheric contaminants, subject to rainfall washout should also decrease with increased distance from the source. Although difficult to quantify at present, elevated levels of cyanide, ammonia, phenols, sulfur dioxide (which becomes oxidized and causes lowered rainfall pH) and particulates (including iron oxides) are expected in waters off the plant site. With prevailing winds, Lake Erie surface waters are expected to receive the bulk of these inputs. However, elevated levels may also be observed in Raccoon Creek, and to a lesser degree, in Crooked Creek. Elevated levels of phenols, iron and lowered pH due to acid rains were observed in Turkey Creek under baseline conditions, with one possible source being urban areas upwind. As yet unquantified increments are expected from plant operations, however, improved emission control at the Ashtabula power plant may offset these increases.

Secondary Impacts

4.958
Impacts on the aquatic biota of Lake Erie and its tributaries in the Principal Study Area and other inland waters in the Regional Study Area due to spin-off development as a result of the proposed project will depend on the following:

- The amount and type of development in each of the affected watersheds,
- The assimilative capacity of each watershed and the amount of development allocated to it,

- The location of development with relation to the flood plain, and
- The effect of increments in sewage treatment as well as effluent increases in each of the watersheds.

4.959
The impact of construction activities on streams or small lakes is dependent upon the extent to which land area is cleared of vegetation; duration of construction, the amount of topsoil lost, and percent of this area that is revegetated and the amount of flood plain and riparian habitat included in the land cleared. The primary physical effects of such activities include increases in surface runoff and soil erosion. This results in increases in stream sediment loadings as well as increases in suspended sediments or turbidity. Furthermore, watershed or drainage area alteration can cause higher stream flows and flooding during heavy rainfall, or lower levels in the absence of rain. This would be especially important for tributaries to Lake Erie in the Coastal Communities, where, because of poor soil percolation, streams already tend to exhibit erratic flow characteristics. In small streams, high flows can widen and deepen the stream causing riffles to disappear and cutting pools deeper. Dry periods may leave broad areas of stream above water level. (4-165)

4.960
Land surfaces, once covered, leach chemicals such as the following, which then are added to stream water:

- Calcium and magnesium from newly laid concrete, and
- Coal tar derivatives such as hydrocarbons and heavy metals from bituminous surfaces.

Such "improved land areas" do not mitigate weather-induced flow variations in streams resulting from initial clearing (although a drop in sediment loading will probably occur). In addition, spills and leakage of petroleum products from construction vehicles include oil and grease. Exhaust wastes, such as lead, may also be added to runoff from increases in vehicular use of paved surfaces. (4-165) The great majority of land developed for this new population is expected to be for residential purposes. Construction impacts due to such population increments would depend, in large part, on where new development is located in each watershed.

4.961
The Crooked Creek Watershed, (which encompasses the Turkey and Raccoon Creek Watersheds) is a rural area with a considerable amount of "open space." Crooked Creek has been designated a "Conservation Stream" by the Pennsylvania DER. The lower portions of Raccoon Creek

are in a county park. Any developments in Springfield that impinge upon flood plain or riparian habitat around these streams could increase siltation or significantly alter flow characteristics. There is a possibility that natural trout reproduction occurs or could occur in one or both of these streams, a reflection of their high water quality. (4-166) Increases in siltation, especially in headwaters reaches could well eliminate this possibility. Walnut and Elk Creeks in the Pennsylvania Coastal Communities are also designated conservation streams, with limited rainbow trout natural reproduction a near certainty in some of the tributaries of the former. While smaller relative increases in population are projected for these watersheds, further development in flood plains and/or including riparian habitat would have the same type of impact potential discussed above.

4.962
Conneaut is fairly well developed near the Lake, it is possible that new developments associated with incremental growth could occur around Conneaut Creek. Any removal of bluff vegetation along the creek, and any development in the Creek flood plain, would increase erosion and sediment laden runoff with impacts discussed above. Flood plain areas along the Ashtabula River would also be susceptible to new development impacts, but this stream apparently has less existing habitat value than those discussed above, and fewer new residents are predicted in the communities bordering it. Saybrook, Kingsville Township, and North Kingsville Village are in flood plains drained by very small tributaries to Lake Erie. A larger incremental growth is expected in the latter two municipalities. Development-related increments in sedimentation in these tributaries could alter stream flows characteristics which already have been found to be quite low during dry summer periods. As with other tributaries discussed, this sedimentation can affect benthos and fish populations, but the extent of such populations in these smaller tributaries is not well quantified.

4.963
In those communities which lack municipal sewer systems, or have antiquated systems near capacity, additional impacts on surface waters from septic or package plant discharge are a possibility. Utilizing the scenario of projected population increases in various municipalities derived from the SIMPACT IV modeling effort, the unsewered communities nearest the project site would be impacted to the greatest extent. If a significant portion of the projected level of development occurs in Kingsville Township and North Kingsville Village, and the Springfield area in Pennsylvania before these areas are sewered and connected with larger sewage treatment facilities, biota of local streams could be affected by the effluents from population increases. Septic systems, although few are expected, can

leach pollutants into nearby waters. Small package treatment plants will also add some pollutants to these small streams, which in general do not possess sufficient assimilative capacity to absorb such inputs without adverse biotic impacts. Red Brook and Cowles Creek in Ohio are examples of similar small streams that have experienced residential and industrial development. Elevated levels of metals, nutrients, bacteria with subsequent lowered DO in summer months are all evident when water quality data are compared with Turkey Creek (with very little development). (4-78) Such contaminant levels, although not extremely high, can affect changes in stream biota to more facultative species. Elevated levels of residual chlorine can have a similar effect, as in Walnut Creek. (4-167)

4.964
If the city of Conneaut reduces infiltration problems in its sewer system, the impacts on Conneaut Creek, related to elevated nutrients and high coliform levels, should be reduced. If a new sewage treatment facility is constructed at the mouth of Elk Creek, and service is extended to include industrial and municipal systems for Lake City, Girard Borough and Township, and Fairview Borough and Township, conditions could improve in local streams where some degradation has been observed (4-167). While development pressure due to the proposed project is not expected to be heavy in these areas, any increase in development could add pressure on existing out-moded facilities.

Roads: Construction and Runoff

4.965
In general, continued surfacing of existing dirt roads is expected in this region, rather than construction of new roads. The major impact of these activities on streams is the increase in urban-like runoff: lead, oils, road salts will increase in runoff and affect streams, especially at road crossings. As currently proposed, there are two new roads projected that would extend offsite from the west and east access roads on the Lakefront site. Two locations have been considered for the western access road: a Route 20 by-pass (see Chapter 6) and the State Line Road access to I-90. This latter route may cross one small portion of a Conneaut Creek tributary headwater. The former route, however, would cross the main stem of Conneaut Creek and one tributary headwater to Conneaut Creek. Widening, bridging and increased traffic would have all the types of construction and runoff impacts discussed above. The east access road to 6N and I-90 is also proposed to cross headwaters of Turkey Creek, possibly in a number of locations. Again, impacts will be similar to those discussed, but due to the small size of this stream at these locations could seriously offset benthos composition and reproductive habitat.

Protected Species

Terrestrial Species

4.966
There are three terrestrial species on the Ohio List of Endangered Wild Animals that have been found on the proposed Lakefront Plant site in 1977 or 1978. Spotted turtles were found in the spring in pools of standing water along railroad tracks on the site. This habitat would have been modified or eliminated due to changes in drainage of the area if the original proposal to divert Turkey Creek to Conneaut Creek were implemented. However, the original plan has been abandoned by the applicant and the new culvert proposal should not result in significant drainage of this habitat. Mitigative measures to achieve protection of the spotted turtle population on the Lakefront Plant site are discussed in Chapter Five.

4.967
A single four-toed salamander was observed in April 1978, on the eastern edge of the site, just north of the Conrail tracks. None of the proposed activities are expected to impinge on this area of the site. The two other locations on site with reportedly suitable habitat for this salamander (providing standing water, clubmoss and deciduous woods) are in the area where plant facilities have been proposed. However, no four-toed salamanders have been found in these latter areas as of April 1978. Loss of habitat for this species would be of concern, because it is relatively rare throughout its range because of specialized habitat requirements.

4.968
The sharp-shinned hawks regularly observed during 1977 on the proposed project site would not be expected to make other than migratory use of the site during plant operations. This species is a raptor characteristic of relatively rural areas, especially woodlands, and is rarely, if ever, a resident of areas characterized by heavy industrial development. The potential loss of habitat for the species is not considered significant, because the species is not considered truly endangered or even rare, but rather seems to be listed because it is near the edge of its range in Ohio. In addition, only low numbers of the species were observed to make use of the site during 1977.

4.969
There are many specimens of plant species considered scarce, but not protected by Ohio and/or Pennsylvania located on the proposed project site. Several of these would be removed during clearing. Many of the species involved may be abundant in other parts of the United States, but are considered rare in the Regional Study Area by

involved scientists and/or organizations. Twenty-two Ohio and two Pennsylvania plant species collected on the proposed project site in 1977 can be so categorized, and the locations from which they were recorded are shown in Figure 4-118. Because none of these species are considered rare or endangered on a broad geographic scale, the potential losses represented by Lakefront site development appear to be locally, but not regionally, significant.

Aquatic Species

4.970
Several fish species and one species of water-dependent bird which appear on either the Ohio or Pennsylvania "Endangered" lists have been recorded during 1977-78 in the immediate vicinity of the proposed project site (see the Protected Species baseline section of Chapter 2). These are (followed by the State in which protected or indeterminate status exists) as follows:

- Black Bullhead (Pennsylvania: "indeterminate"); present in Turkey and Conneaut Creek samples.

- American Brook Lamprey (Ohio): nine specimens collected from Raccoon Creek, Pennsylvania.

- Sea Lamprey (Pennsylvania: "indeterminate"); not collected by the applicant, however, during their 1977 lamprey survey, the U.S. Fish and Wildlife Service confirmed the presence of ammocoetes at several locations in Conneaut Creek and Raccoon Creek, but not Turkey Creek.

- Sauger (Pennsylvania: "indeterminate"); one specimen collected from mouth of Conneaut Creek, OH. Ohio stocks this species in Sandusky Bay.

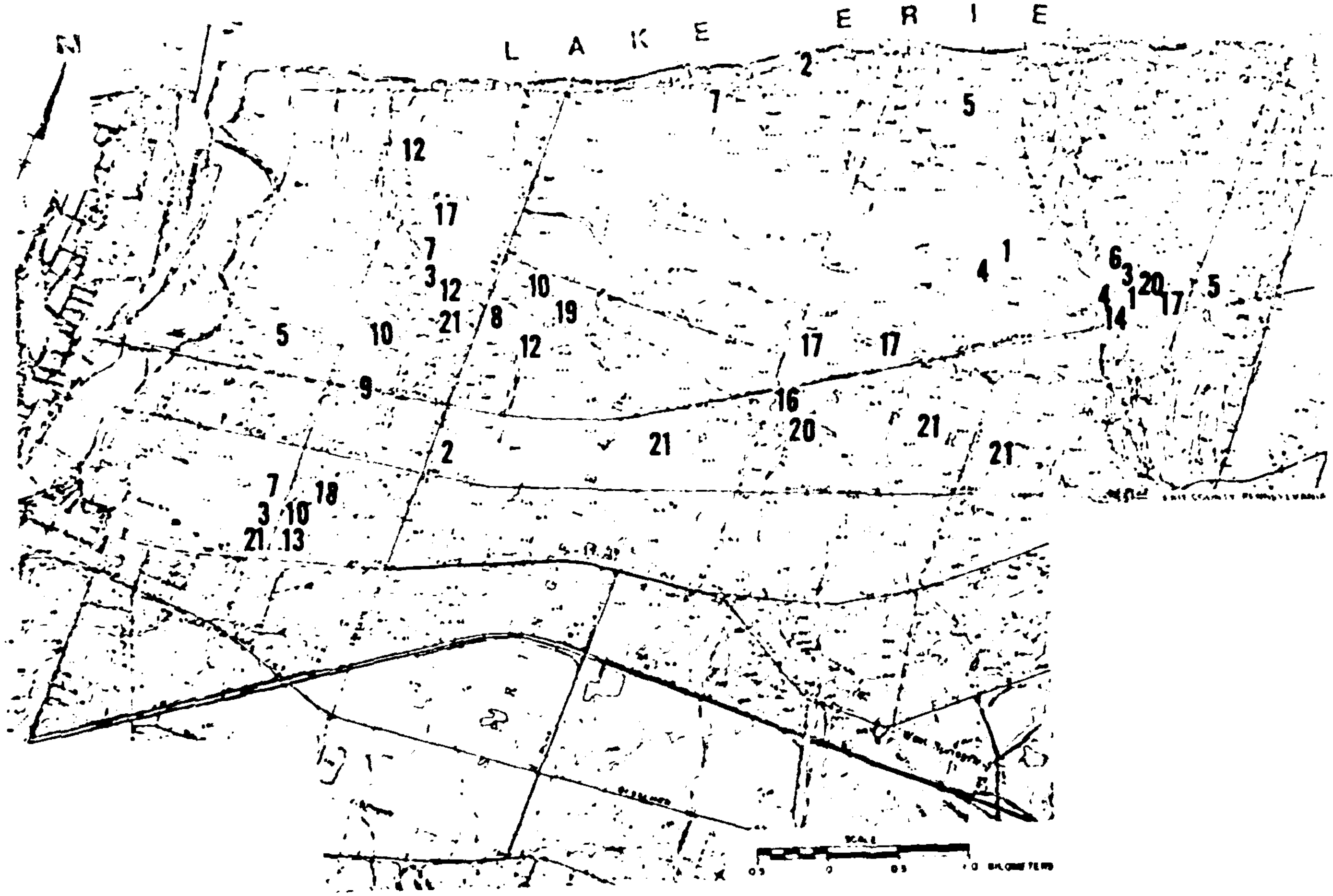
- Orangespotted Sunfish (Pennsylvania: "indeterminate"); one unverified field identification from lower Turkey Creek, OH.

- Longear Sunfish (Pennsylvania: "indeterminate"); one specimen collected from Conneaut Creek, OH, south of the project site.

- Mooneye (Ohio): One immature female from Conneaut Harbor and on immature female from the mouth of Conneaut Creek.

- Common Tern (Ohio); seen off the site over nearshore waters.

In addition, the longnose dace, which is proposed for protection by the Ohio Historical Society, was collected in both Ohio and Pennsylvania waters.



(Legend on the Following Page).

Source: Aquatic Ecology Associates.

FIGURE 4– 113 LOCATIONS OF AREAS WHERE RARE PLANTS WERE COLLECTED ON THE PROPOSED LAKEFRONT PLANT SITE

LEGEND FOR FIGURE 4-118

1. Acer pennsylvanicum
   (Striped maple)
2. Apocynum sibirium
   (Indian hemp)
3. Arisaema triphyllum
   (Jack in the pulpit)
4. Betula lenta
   (Sweet birch)
5. Betula Populifolia
   (Gray birch)
6. Botrychium lanceolatum
   (Grape fern)
7. Cinna latifolia
   (Wood reed)
8. Echinochloa walteri
   (Barnyard grass)
9. Euphorbia glyptospherma
   (Spurge)
10. Gentian saponaria
    (Soapwort gentian)
11. Larix laricina
    (Tamarac)
12. Lilium superbum
    (Turkscap lily)
13. Lobelia puberula
    (Downy lobelia)
14. Lonicera oblongifolia
    (Swamp honeysuckle)
15. Magnolia tripetala
    (Umbrella magnolia)
16. Penstemon laevigatus
    (Beard tongue)
17. Prunus pennsylvanica
    (Pin cherry)
18. Salix bebbiana
    (Bebb willow)
19. Sedum telephium
    (Orpine)
20. Spiranthes lucida
    (Wide leaved ladies' tresses)
21. Veratrum viride
    (False Hellebore)
22. Viburnum opulus
    (Girlder-rose)

4.971
Only one of the above species (the mooneye) is considered rare or endangered over a broad geographic range. In fact, some are quite common outside the Regional Study Area (e.g., black bullhead and common tern). Of the potentially prevalent fish listed, the black bullhead and sauger are notably tolerant of turbid, water-quality limited waters, and would be unlikely to experience limitations from the predicted Lakefront Plant-related effluents. A relatively insignificant amount of habitat for the black bullhead (even at a local scale) would be lost if part of lower Turkey Creek were culverted. However, this species is tolerant enough of siltation and low flows to be expected to be among survivors in the creek.

4.972
Mooneye populations may have decreased in the Lake Erie drainage because of sensitivity to turbidity. Specimens taken by the applicant's consultant were, however, captured in a relatively turbid area. Proposed harbor modifications could increase turbidity in the harbor. The use of silt curtains during the construction phase activities, as discussed in Chapter Five, would decrease this potential impact.

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